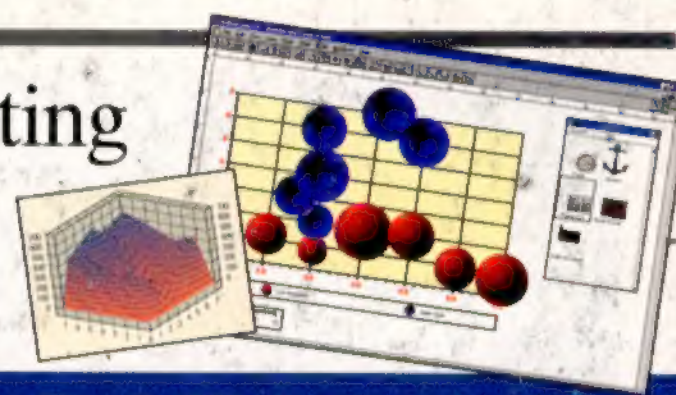




Business Graphics Selecting The Best Charting and Diagramming Tools



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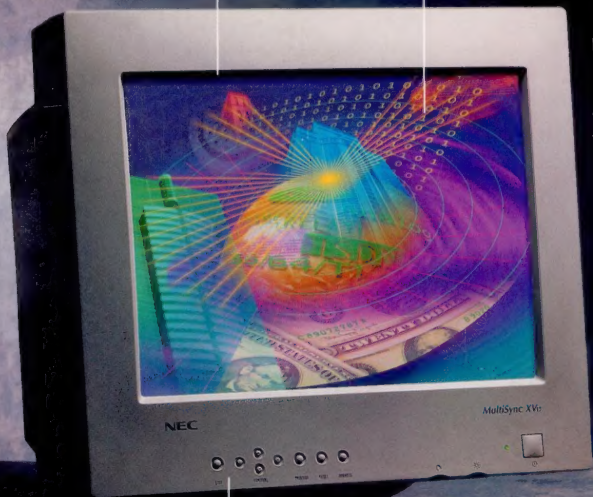
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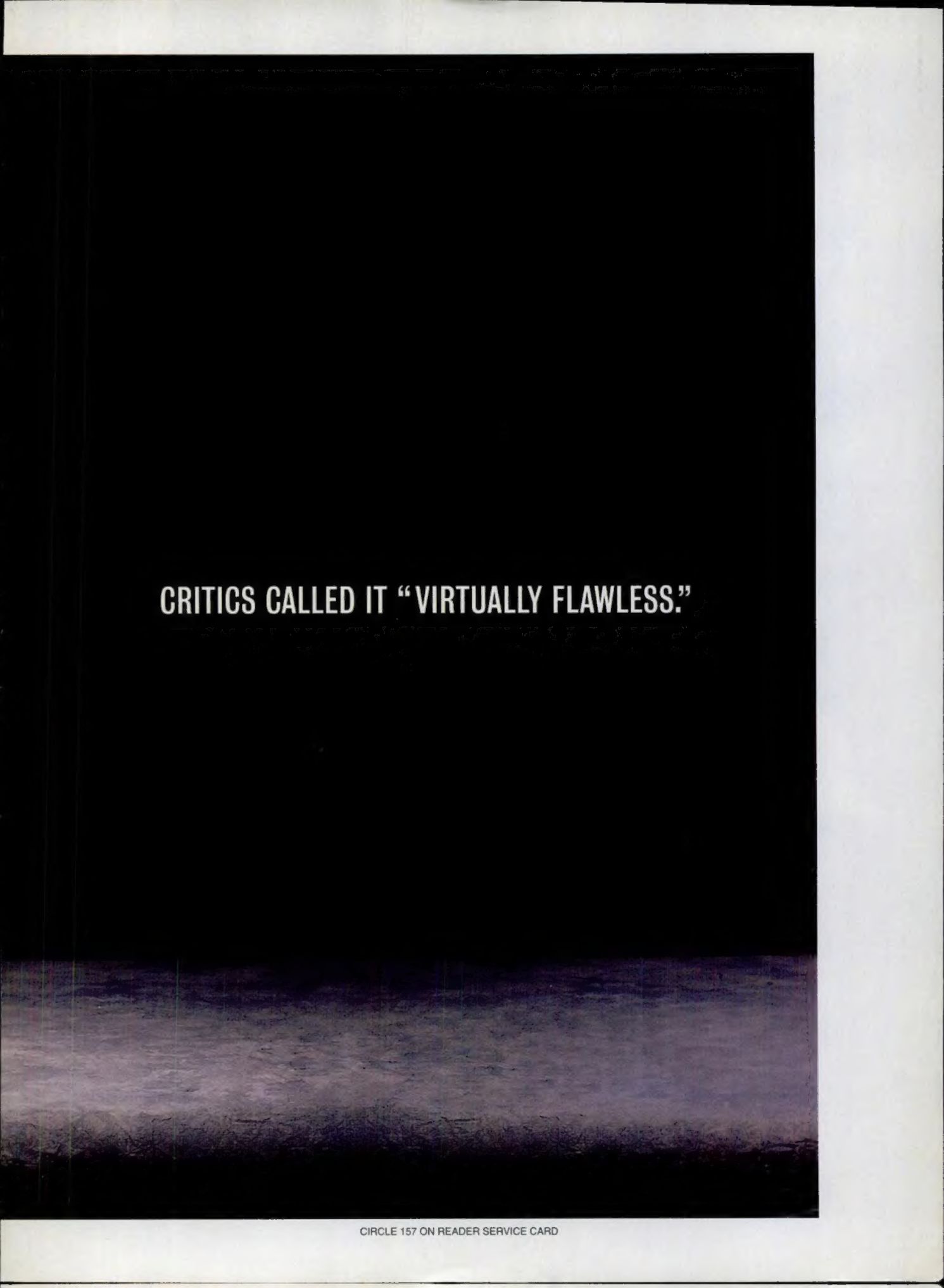
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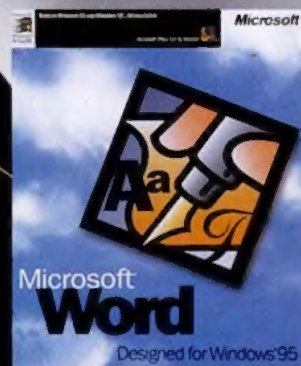
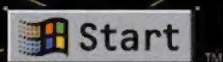


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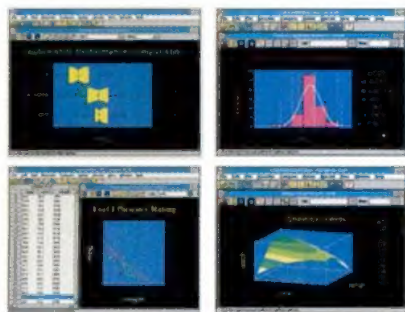


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CIRCLE 365 ON READER SERVICE CARD

Inside

The Internet's World-Wide Web has undergone quite an explosion in the past year. By most estimates, there now are hundreds of thousands of sites around the world, each containing information that anyone with a Web browser and an Inter-

net connection can look at. Millions of people are surfing this sea of timely, instantly accessible information.

But how do you separate the sites that are worth your time from those that are mere fluff? At *PC Magazine*, that task falls to our Internet reviews team, headed by senior editor Tom Mace and project leader Jay Munro and aided by executive editor Don Willmott. This team receives plenty of help from the team that puts together our own on-line sites, headed by executive editor Rick Ayre.

To create this issue's analysis of our "Top 100 Web Sites," Tom and Jay oversaw an extensive analysis by *PC Magazine* editors and the *PC Magazine Labs* staff. Together, dozens of our analysts reviewed thousands of sites in order to come up with our list of the best. They rated each site's content, design, ease of navigation, and innovative use of technology.

Of course, you might find it easier to check out all these sites

from a browser, and the best way to do that is to start from our on-line version of the story—available at our Web page at <http://www.pcmag.com>. From there, you'll be able to jump directly to each of these sites.

The Web is always changing, and we're constantly looking at



new ways to keep you up to date. For users of Netscape Navigator 2.0, we're experimenting with the use of frames to let you see simultaneously our comments as well as the sites we're talking about. And for everyone, we'll be updating the on-line version of the *PC Magazine* Top 100 Web Sites story constantly as great new sites come on-line.

—Michael J. Miller

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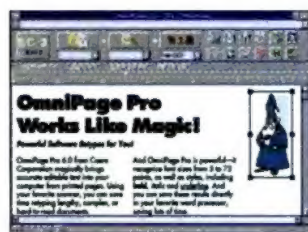


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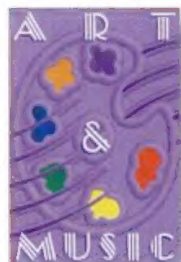
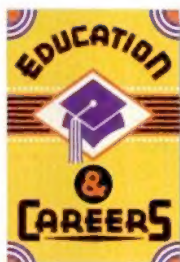
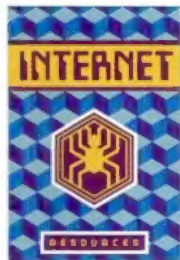
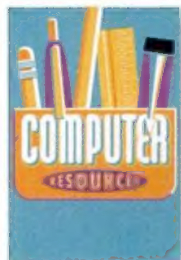
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The 100 Top Web Sites

BY CADE METZ The World-Wide Web has reached such gargantuan proportions that finding the good while avoiding the bad and the ugly has become an intimidating task. After inspecting thousands of sites, we've compiled and reviewed the 100 most informative and technically savvy to help you in your search. In case you are not on the Web or don't know your way around it, we also offer a guide to getting connected and a list of search tools ...100



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Digital Cameras: The Death of Film?

BY DANIEL GROTTA AND SALLY WIENER GROTTA

Can today's filmless cameras give you the excitement that owning your first Polaroid did? For *PC Magazine's* debut digital camera roundup, we selected six entry-level units designed primarily for the nonprofessional photographer. All of the devices are as easy to use as any point-and-shoot camera, and uploading images to your PC requires merely attaching a serial cable. But will these fun and sexy units replace film? Before you throw away your 35-mm, take a look at the images produced by our tests.....145

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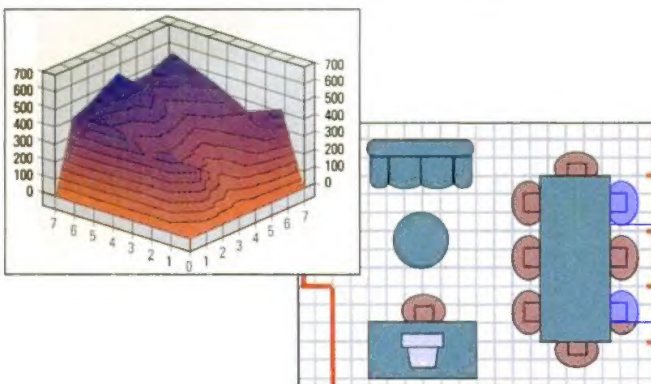


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Business Graphics: Draw Your Own Conclusions

BY LANCE ULANOFF

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*Available on PC Online.

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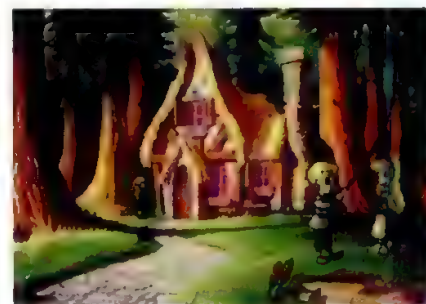
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BY FRANK J. DERFLER, JR.

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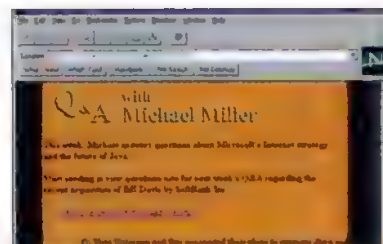
Can you help Hansel and Gretel get home? (page 364).

PC MAGAZINE BEYOND PRINT



What's New Online

Every Tuesday on PC Magazine's World-Wide Web Site, editor-in-chief Michael J. Miller has a question-and-answer column. It's an opportunity for readers to write in and ask Michael about the latest developments in the computer industry. Be sure to make a Q & A with Michael J. Miller a regular stop on your Web tour.



PC Magazine CD: Winter 1996 Issue

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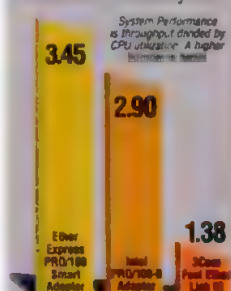
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WM You can even get WinFax PRO as part of new Delrina CommSuite™ 95, the complete, affordable, integrated communications software solution for Windows 95. **WM** All of which should suffice until the new alpha wave faxing program is ready. (Hmm. Perhaps if we *partition* your brain so that one half can receive faxes while the other remains undisturbed...) **DELIRINA**

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Letters

INTERNET VIEWS

I found the coverage of on-line services in your issue of October 10, 1995, to be very comprehensive. But one point bothered me. You reported the nationwide access speeds of America OnLine as 28.8 kilobits per second. In reality, these connection ports are only available in major metropolitan areas. I live in Athens, Georgia, a town that—while it is not L.A., Chicago, or New York—is home to a major University (U.G.A.). Guess what AOL's top speed is? Can you say 2,400 baud? Why don't you write about the rest of us and expose the pathetic service in nonmetro areas?

GREG WARDLAW
via the Internet

In the Summary of Features Table of Commercial On-Line Services, you indicate that all providers have at least 9,600-bps service to the cities they serve. From personal experience, I know that neither CompuServe nor America Online provide access faster than 2.4 Kbps from here in Tuscaloosa, Alabama. I also know from discussions with CompuServe that no higher baud rate is planned for Tuscaloosa in the immediate future.

DOUG TAYLOR
via the Internet

Hi. I loved your stories on how to make the Internet work for you. I read it before I was on the Internet, and then I read it again as soon as I got on. I can't wait to read more articles about the Internet.

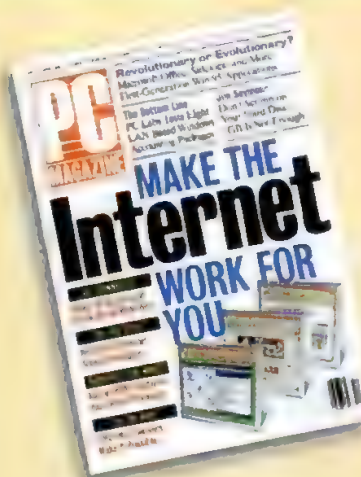
SCOTT HELLEWELL
via PC MagNet

I thoroughly enjoyed your issue on the Internet. A major quibble: AOL is not an option for anyone outside the continental U.S. as there is a 20-cent-per-minute surcharge (which adds up to \$12 per hour) on top of the regular fees. A minor quibble: The Pro version of Eudora may be an excellent app, but Pegasus is free and consistently rated as the best by other industry magazines I've read. Connectsoft's Email Connection is also rated as excellent, and after extensive use of both, I'd have to concur. Otherwise, thanks, and keep the interesting issues coming.

PAUL MORRIS
Hamilton, Ontario, Canada

Your issue of October 10, 1995, on the Internet was one of the most informative I've read. I just started a new position in which it is imperative that I know all aspects of on-line service. I bought several magazines, but in the future I will be buying only one: *PC Magazine*.

K. LEE COOKSEY
via the Internet



*Maximizing the
Internet's resources is more
viable than ever.*

Having just installed an ISDN modem and looking for an Internet service provider, I was disappointed to find that your information regarding the Microsoft Network was incorrect. You stated that they support ISDN. In fact, they have never heard of ISDN.

JULIAN SOLE
via the Internet

Every time I get hold of a copy of *PC Magazine*, the first thing I look for is articles about the Internet. So much has been said about the Net, but there's always more to know. Your articles on the Internet are enlightening not just to Internet newbies but also to veteran Netizens. More power to you.

ERIC C. CONCEPTION
Manila, Philippines

Congratulations on an excellent October edition. I have been using CompuServe for years but am just starting to use the Internet. Your articles on making the Net work for you are invaluable.

BARRY DUXBURY
via PC MagNet

DO YOU HAVE MY NUMBER?

I'm usually quite an unflappable fellow. But how you can give Editors' Choice awards to Dynamics LAN and Solomon, ("The Bottom Line on Windows," October 10, 1995)—two accounting packages that lack multicurrency transaction capabilities in their accounts receivable modules—truly blows my mind.

C.B. REID
Hamilton, Ontario, Canada

AFTERSHOCKS

Michael J. Miller, if you are crazy enough to run for President, I'll vote for you. Your article "Cybersex Shock" (October 10, 1995) was one of the most enlightening I have seen yet on such issues as the Telecom bill, cybersex, and our failure as a society to parent our children. I'm not crazy about mass media and rarely bother to send letters to the editor, but your commentary was one of the few editorials I have seen that did not seem self-serving.

JOSEPH TABACO
via the Internet

I was just having a great day until I read Michael Miller's article on cybersex. It's people like him, who want to rationalize wrong thinking, that are continually sinking the morals of this nation. What's next?

FRANCISCO RAMIREZ
via the Internet

In his column, "Cybersex Shock," Michael J. Miller asserts, "As a society, it's our right and our responsibility to monitor what material is readily available to our children." Can he explain why he believes that? It seems to me that if people are afraid to allow their children access to alternate views, they aren't very confident of their own.

WILLIAM H. CLEVELAND
via the Internet

PROBLEM SOLVED

I was installing a new software package that kept leaving the message "CORRUPTED MFCANS32.DLL" each time I accessed a text file. At first I thought I'd have to do a full reload of Windows 95, but then I remembered a PC Tech Special Report, "The Complete Windows 95 Annotated File Listing" (October 10, 1995). I located the offending .DLL, removed the WordPad, renamed the corrupted .DLL, reloaded the WordPad, and voilà, problem solved in less than 5 minutes. Thanks a million.

PAUL GODIN
Hull, Quebec

WIN 95 WEARY

I have been a big fan of *PC Magazine* for three or four years now, ever since I picked up my first copy at a newsstand. But I've grown tired of seeing articles describing in the most minute detail on how to get Windows 95 up and running. Where were you when I was torturing myself to get OS/2 installed and running in a smooth way? How is it that I, who read your magazine religiously for so long, didn't even know of the presence of the free OS Linux until a friend told me about it? It is all very well to support Windows 95, but many of us do not want it and will probably never



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Letters

use it on our PCs. Don't you think you should live up to your name and try to provide a service for all the owners of PCs?

STEPHEN HOOPER
via PC MagNet

After reading John C. Dvoraks' "Win 95 vs. OS/2: Some Thoughts" (October 10, 1995), I said to myself, "This is too much." How many more evaluations of OS/2's pros and cons versus Windows do we need? I started thinking that this is like the Gulf War. At first, the United States seemed the clear winner, but Saddam Hussein is still in power with his die-hard followers and army intact.

YORAM ADLER
Brooklyn, NY

I have been a subscriber of *PC Magazine* for about five years now, but the substance of the magazine is changing in a direction that I find less and less useful to me. Lately, I have been using OS/2 to good advantage. I have used Windows a couple times but find it superfluous to my work and annoying. I dislike saying that your magazine has become a mouthpiece for Microsoft, but I am left with that distinct impression. On the cover, you say that it's "The Independent Guide To

CORRECTIONS AND AMPLIFICATIONS

In our Twelfth Annual Printer issue of November 7, 1995, the incorrect Hewlett-Packard printer was highlighted as an Editors' Choice on the Summary of Features table (page 240) and in the headline of the review (page 238). We should have highlighted the HP DeskJet 660C as the Editors' Choice winner.

On page 266 of the same issue, the introduction to high-end color graphics printers should have indicated that General Parametrics Corp.'s Spectra*Star 240 and Spectra*Star 280 printers can print on plain paper. Also, the correct price for the Spectra*Star Dsx (page 272) is \$7,695. Finally, the printable area on letter-size paper for the Spectra*Star 280, listed on page 274, should have read 8.1 by 10.0 inches.

On page 290 of the same issue, the correct phone and fax numbers for Star Micronics America are 800-506-7827 and 908-572-3129. Also, the technical-support hours, listed on page 295, should have indicated that live tech support is available Mondays from 10:00 to 5:00, and Tuesday through Friday from 9:00 to 5:00 eastern time. Automated technical support is available 24 hours a day, 7 days a week.

On page 138 of the same issue, the review of Dataproducts Corp.'s Typhoon 8 laser printer should have indicated that DP-Tek is the patent holder of the TrueRes resolution-enhancement technology employed by the printer. More than just an "edge-smoothing algorithm," TrueRes actually doubles resolution from 600-by-600 dpi to 1200-by-1200 dpi. Dataproducts, among others, licenses the TrueRes technology from DP-Tek.

In our roundup of home PCs ("PC, Come Home," December 19, 1995), the NEC Ready 9022 was incorrectly priced. The correct price is \$2,899.

Personal Computing," but it doesn't seem so any longer.

GEORGE A. LESCH, JR.
via PC MagNet

I must express my frustration with respect to your evaluations of Windows 95. You have spent issue after issue featuring Windows 95, and each time I come away with the feeling that I really haven't learned much about how it handles complicated data and multitasking projects compared with Windows 3.1. For a magazine that has extensive numerical assessments of virtually everything reviewed, I have found the articles on Windows 95 disappointing and sometimes even vacuous.

BRUCE McLANAHAN
New Canaan, CT

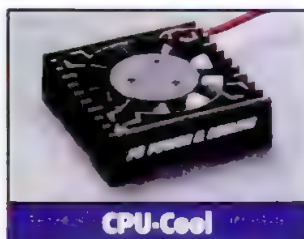
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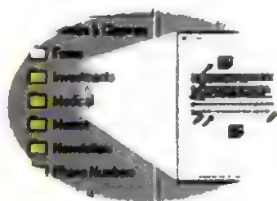
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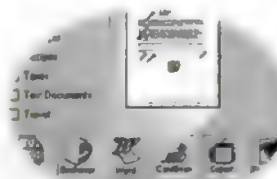
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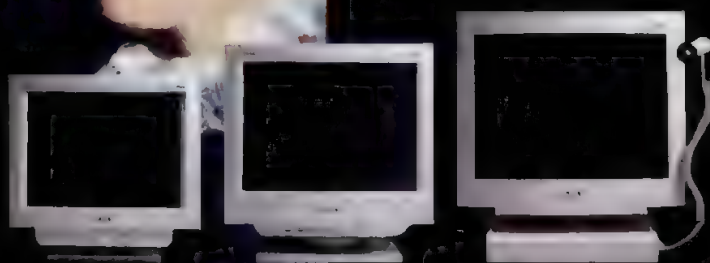
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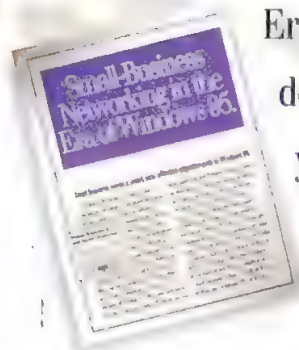
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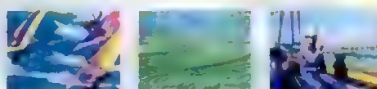
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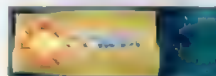
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Being Virtual

During our annual Technical Excellence Awards ceremony at Fall Comdex, I had the rare opportunity to be, well, virtual for a while. Thanks to the help of the San Francisco-based Worlds Inc., our guests were able to watch an "avatar" of me

strolling through the various rooms of our Technical Excellence Awards hall. By using the mouse or pressing a few buttons on the keyboard, I could move the virtual "me" in various directions, tilt my head, and even fly. Pretty neat, huh?

My avatar was specially designed by Worlds Inc. using a series of photographs of me. An avatar is a 3-D graphical icon that represents the user in virtual space. Those of you who logged onto our World Wide Web site (<http://www.pcmag.com>) and downloaded Worlds's AlphaWorld software could use a more generic avatar to watch the ceremony, walk around the halls, and have an online chat with me or others in the virtual rooms.

So, how well did it work? Well, the technology certainly helped put on a good show. It's a strange experience—generally pretty pleasant, but also a little disorienting—to see yourself (or a simulation) walk through a virtual world. But it is a provocative way of seeing and moving through information, and one I'm sure will become more widespread as the technology improves. Virtual reality gives us the opportunity to do things we never could before.

Right now, you can visit AlphaWorld, which includes our Technical Excellence Awards hall; a VR city called Cyber-town that includes "The Colony," a way of setting up your own virtual apartment; various VR shopping malls; and even a VR tour of San Francisco's South of Market Street area. Virtual reality also has the potential to do some amazing things. For instance, Starbright Foundations is working with Intel, Sprint, UB Networks, and Worlds Inc. to provide a virtual-reality method of linking hospitalized children across the country. To me, this is a great example of using state-of-the-art technology to help people.

Of course, Worlds Inc. is only one of many approaches to virtual reality. Intervista is another



VIRTUAL VENTURE

It's strange to see yourself walk through a virtual world.

pioneer, particularly in the use of Virtual Reality Modeling Language (VRML), the emerging standard for virtual reality on the Web. Other companies involved in building virtual worlds include Intel, Silicon Graphics, Template Graphics, and Virtus.

Microsoft is currently bundling an Intervista VRML viewer with the latest version of its Internet Explorer. Meanwhile, Netscape and others are working on their own extensions to VRML.

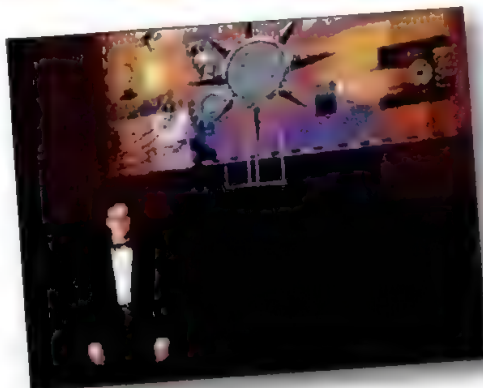
In addition, several companies are now working on VR as a front end for interactive chat sessions, most notably CompuServe, Microsoft with its V-Chat, and Worlds Inc. with its Worlds Chat site. Chat sessions make it easy to communicate with people you don't know, and you can do things like pretend you're someone else. When you can use an avatar that looks like you (or your favorite cartoon character, a movie star, or simply the way you'd like to appear), it adds another more exciting, and perhaps

more disturbing, dimension.

One thing we know for sure is that there will be no shortage of possibilities in virtual space, and people will be able to do things there just as they can in the real world. For instance, a couple of weeks after our Technical Excellence Awards ceremony, our gallery was trashed by electronic vandals, who figured out how to move objects around. Online editor Tin Albano was forced to send his

avatar chasing after them, saying things like "Stop, thief."

But that's okay. It's just part of the growing pains associated with any new technology. VR isn't a panacea for any of the world's problems, and it's unlikely to be ready for mass use anytime soon. But it does point the way to a new form of communication—one that has the potential to change radically the way we interact with one another. □



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Trends

TRENDS & TECHNOLOGIES SHAPING THE PERSONAL COMPUTER MARKET

Video To Go

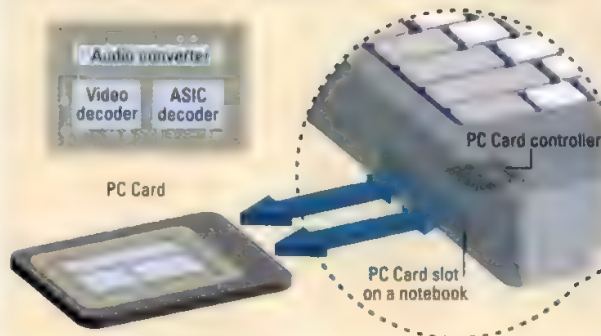
Full-motion action—on a plane or a train.

Notebook computers have done a pretty good job of incorporating technologies found on desktop systems, except in one key area: full-screen, full-motion, digital video. Until now, excessive CPU utilization, contention for PCI bus resources, battery drain, and costs have set back portable video.

A new PC Card-based standard, Zoomed Video, which aims to transfer video data directly from a PC Card to video and audio systems through a PC Card-based bus, is targeted to break the notebook video barrier. The new technology has significant backing from Chips and Technologies, Cirrus Logic, C-Cube, Sony, Sigma Designs, Toshiba, and other vendors.

Toshiba is likely to be the first out the door. Last fall the company announced that it had incorporated its ZV Port technology across its entire notebook product line. According to Gary Elsasser, director of product planning at Toshiba, "The ZV Port combines with a modified graphics controller, PC Card controller, and a notebook motherboard connection between them to deliver full-motion video data transmission at up to 27 Mbps, or 24 bits at 640-by-480 resolution at 30 frames per second."

Portable PC Card Technology



Sony's PC Card camera (atop notebook) and TV tuner (inset, below left).

dard is an adaptation of the PCMCIA port to let a type of PC Card called a ZV Port Card be inserted into a notebook. This architecture eliminates sending large amounts of video and audio through the CPU or system bus.

Sony is also working on a bundle consisting of a Zoomed Video PC Card, video camera, proprietary software, and connector cable. Chips and Technologies, along with Sony, recently demonstrated a notebook capturing live video over a tiny video camera and displaying it on screen via Sony's Zoomed Video PC Card.

Initially, Zoomed Video solutions like Sony's and Toshiba's are targeted at video playback of MPEG 1 full-motion video, video capture, TV tuner support, and video conferencing. The technology is also targeted as the first step in incorporating SD-ROM (super-density ROM) and MPEG 2 into future notebook PCs. Several vendors are working on Zoomed Video, PC Card-based (super density) solutions for video encoding, capture, and playback—all on one card.

compromises required with Zoomed Video solutions. While Zoomed Video removes the video stream from contention for the PCI bus and CPU, other multimedia elements will continue to demand those resources. And the Zoomed Video port itself does draw additional power. Still, it doesn't place demands on the CPU, so Zoomed Video may represent a better solution for portable full-motion, full-screen video than software MPEG as

used in the IBM ThinkPad.

Alex Daly of C-Cube says, "Software MPEG utilizes the CPU and typically means about 6 watts of power consumption. The Zoomed Video reference design we're offering to OEMs requires only 2.5 watts—enough to watch a 2.5-hour movie."

Daly points to notebook-based movie watching, video-enabled presentations as the initial "killer apps" for Zoomed Video on notebooks.—Sebastian Rupley

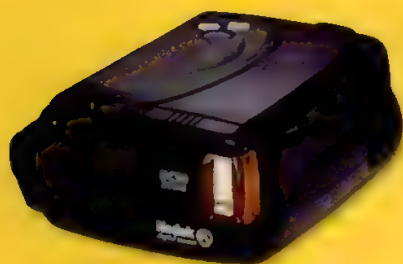
Integration, Japanese Style

IBM Japan's Palm Top PC110 is a refreshing lesson in integration. At 6.3 by 4.5 by 1.3 inches and at 1 pound 6 ounces, the Palm Top PC110 is the lightest notebook PC yet. Its specs read like a road warrior's wish list: 486SX/33 processor, 8MB of RAM, audio, lithium ion battery, 4.7-inch color display, and



touch-sensitive area for writing notes. Close the lid, and you have a fully functional cellular phone that can be connected to land lines to save money. What it lacks is an internal hard disk drive, but the Palm Top PC110 has 4MB of internal flash memory as well as a PC Card disk drive. The Palm Top PC110 shoehorns the most PC into the smallest case — Brian Kiefer

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Browsable, Searchable TV

TV shows could be the next wave in Web content.

Scientists at Bell Laboratories are doing field trials of a new technology that automatically creates and stores text and still-frame video transcripts of television programs on the Web. Several major television broadcasters will soon announce partnerships with Bell Labs.

Bell Labs' technology is built around software capable of distinguishing significant still images from a television program and storing them in parallel with a text transcript of the TV program. The text transcript is captured from the show's closed-caption transmission and converted to HTML format, and hypertext links are added to the text transcript to make the document searchable. The software uses a method called content-based sampling to perform video captures when signalled by content shifts such as cuts, fades, and shifts in camera angles. The video-and-text transcript is stored on a Web site within minutes of the program's conclusion.

News delivery is targeted as the killer app for the technology. For example, if you missed the evening news but knew that a story on Kuwait had appeared, you could access the Web site of a major news broadcaster, search for Kuwait, read through the story, and view video captures in parallel with the text. If information specific to the geography of Kuwait appeared in the story, you could click on a link to other Web-based information on Kuwait, then return to the story. Bell Labs

ATM Heads for the Desktop

25-Mbps networks rev up.

ATM may finally be set for the desktop. Even as standards have materialized, ATM (Asynchronous Transfer Mode) is still perceived strictly as a solution for a distant backbone or WAN, not as a network solution for office PCs. But recently, several networking companies have announced 25-Mbps workgroup solutions they hope will bring ATM to a desktop near you.

Of course, PC applications cannot yet talk to ATM desktop adapters directly; native ATM APIs probably will not ship until 1997 (the beta of Microsoft's developer kit for ATM Winsock will arrive early this year).

In order to build an ATM workgroup infrastructure, you need LAN emulation (LANE), which allows ATM to support existing

protocols and networks.

Madge Networks recently announced what it calls the first complete, standard-based ATM workgroup solution. Its Collage 25 PCI Adapter for clients, Collage 155 PCI Adapter for servers, Workgroup Switches, and LAN emulation software are designed for 25-Mbps ATM on a small scale. The main buyers of such ATM products are still testing labs, but Bill Jeppesen of Madge says, "Businesses that move large data streams—such as full-motion video—will soon build an ATM infrastructure."

Adaptec has been shipping 25-Mbps network interface cards since June 1995. Its

Adaptec ATM25 and ATM155 client adapters have not yet found a place in real-world workgroups, but this should change in 1996 as ATM becomes more prevalent in servers and

the backbone. "The only way to get good performance out of an ATM server is to have ATM on the client, which we use our own



TV NEWS ON THE WEB: How about searching a transcript of "Newshour with Jim Lehrer"?

with Jim Lehrer" transcription, featuring a few hundred still images and a complete hypertext transcript, you can still fit the whole transcript on one floppy disk."

The software is also intelligent enough to keep necessary video captures to a minimum. For example it will not repeatedly capture a shot of a news anchor delivering the news in exactly the same position. Unique visual content is what gets captured.

Shahraray says Bell Labs has done field trials on many different kinds of content for major broadcasters. For example, sports events have been transcribed (baseball works better than football, because less action means fewer video captures); and all kinds of news shows have been tested.—*Sebastian Rupley*

emulation client for," says Adaptec's Gary Law.

Fore Systems, makers of the 155-Mbps ForeRunner ATM Product family, has also announced plans to develop a 25-Mbps ATM solution. "Many low end machines that are currently on the desktop can't handle 155 Mbps," says Don Reckles at Fore, "and many existing LANs are wired with Category 3 cable, which can't support 155 Mbps."

The ATM Workgroup crowd also includes IBM, which is ship-

also has a version of the technology designed to facilitate full-motion video transcripts and audio segments captured in parallel with text transcripts.

According to Bell Labs' Behzad Shahraray, "A 90-MHz Pentium can produce a TV show transcription using about 60 percent of the CPU cycles. Even with a one-hour "Newshour

with Jim Lehrer" transcription, featuring a few hundred still images and a complete hypertext transcript, you can still fit the whole transcript on one floppy disk."

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ping 25-Mbps solutions on a variety of platforms. Together with IBM's 8260 ATM Hub and LAN emulation software, these systems allow for migration from existing Token-Ring and Ethernet networks to ATM.

"Fast Ethernet and 100VG-AnyLAN can offer you good networked multimedia, FDDI can offer high capacity, and Smart TDM can offer good voice integration," says Jeppesen, "but ATM is good at all three."

—*Cade Metz*

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Globalizing Encryption

Software industry lobbies to overturn export restrictions.

As commerce transforms the Internet, the need for reliable encryption is more important than ever. But companies that use encryption technology developed in the U.S. may find that their ability to compete globally is limited.

Under current U.S. policy, much encryption technology can't be exported. Many software packages that contain a U.S.-made encryption engine can't be sold outside the U.S. But encryption technology developed elsewhere can be imported into the U.S.

"This policy is enormously damaging to the U.S. computer industry," says Kurt Stammberger, marketing manager at RSA Technology. (RSA's encryption engines are the de facto standard for most software developed in the U.S.) He says that the government is succeeding only in delaying the inevitable development of inter-

national encryption standards. "The general consensus in the industry is that 1996 is going to be a make-or-break year as far as encryption technology is concerned, primarily because of what is happening with the Internet," he says.

RSA and other organizations, including the Business Software Alliance, which represents Microsoft, Lotus, and others, have lobbied diligently to overturn the restrictions. The BSA recently presented its agenda to the administration.

The first statute calls for separating export control issues from national encryption policy; the second recommends that the export of software that uses the Data Encryption Standard (DES) algorithm or other algorithms of comparable strength be permitted, as long as information about the program is given to the National Security Agency.—*Sarah L. Roberts*



Web Auditing Gets Serious

New software aims to tally Web-page popularity.

Just how many people are actually seeing online advertisements? Until very recently, getting an accurate tally was a tall order. The industry had no standard for collecting and analyzing data on Web traffic, and by most accounts, the ways in which companies were figuring total measurements were making the results highly inflated. Things are changing quickly.

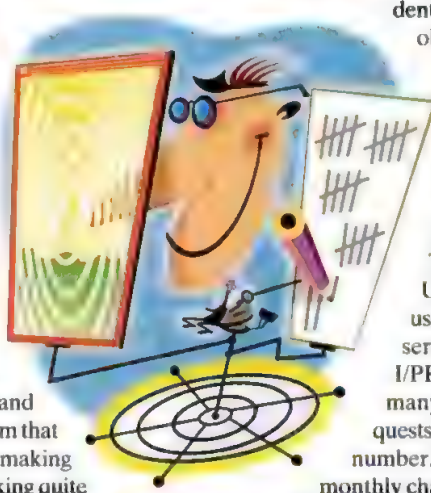
Advertisers such as Chrysler and MCI are increasingly demanding ways in which to better understand how and where their dollars are being spent online. As a result, companies like the Audit Bureau of Circulations, the leading auditor of print materials including magazines and newspapers, and Nielsen, the television ratings firm that recently teamed up with I/PRO, are working on making Web tracking reliable. ABC and Nielsen are backing quite different technologies and methods.

ABC's method of tracking is based on MarketArt's WebTrack software. The audit software has three major components: The Monitor, which resides on a client's Web server, is responsible for the actual collecting of data; the Audit Host runs the database of statistics that are used to analyze the data the Monitor collects; and The Pre-Audit Re-

ports are the HTML pages that provide an hourly, daily, and monthly results report. The checks and cross-checks the software provides result in dozens of types of statistics. Officials at WebTrack say the fact that a log is created by the WebTrack software, completely independent of a client's own Web server, ensures third-party objectivity. ABC plans to release the software in January, although the cost is not set yet. Dozens of companies including *The New York Times* company, *Hachette*, and *Mecklermedia* are now testing the beta software.

Nielsen and I/PRO are using I/PRO's proprietary tracking technology. The first component, called I-Count, is used to track usage data. The second component, I/Audit, offers validation. Unlike WebTrack, however, the I/PRO software uses the data that is accumulated on a client's Web servers to tabulate and analyze. Like ABC, the I/PRO software generates reports that summarize many statistics. For example, many find page requests—as opposed to total hits—to be the most reliable number. The I/PRO software is available now at varying monthly charges. I/PRO customers include Netcom, Pacific Bell, and Sun Microsystems.

According to the New York-based WebTrack, almost \$12.4 million was spent in online advertising in the fourth quarter this year. And 1996 will certainly see that number grow. Arbitron is looking to enter the market, as is Digital Planet Corp. Smaller companies will soon be able to look to several off-the-shelf options for Web auditing.—*Angela Hickman*



By Jake Kirchner

You Can't Get a Cold Beer in a Computer Store.

When it comes to buying a home PC, I'm strictly a mail-order kinda guy. And why not? I'm not afraid to crack the case if necessary, and I sure do like saving a couple hundred bucks. Moreover, in ten years of direct buying, I've never been burned, flimflammed, or bamboozled.

I must admit that perhaps the main reason I prefer buying direct is that it means I don't have to shop in retail computer stores. Not that shopping retail is a horrible experience; it just tests your sanity.

No matter how much you know about personal computers, you're going to run into a salesperson who sets your head spinning by insisting that you don't really want any external cache memory because the whopping 540MB drive obviates the need for it. Or who tells you confidentially not to consider the Digital machine because "everyone in the industry knows they're going out of business soon." Even if you picked that store specifically because you wanted a Digital PC, there's no way you can walk out with one under your arm without feeling like an idiot. Trust me, that doesn't happen when you buy mail order.

I'm not saying no one should buy retail. For the millions of people who need or want the hand-holding and the easy return and service options that retailers offer, spending a few hundred extra bucks is worth it. Here's a test: If the prospect of opening your computer and replacing a bum video card is scarier than servicing your car's automatic transmission, stick with retail.



In ten years of direct buying, I've never been burned, flimflammed, or bamboozled.

Other tests: If you can't understand why floppy disks are hard, stick with retail; if you station a fire extinguisher near your computer "just in case," stick with retail; if you think leaving your mouse upside down will confuse it, stick with retail.

But in my mind, there's one overwhelming reason to avoid retail PC purchases if you can. It's what I call the Sony decision. The Sony decision is the modern, home electronics version of the IBM decision, which was based on the 1970s dictum, "No one ever got fired for buying IBM." In other words, it's the safe choice.

You know the routine well if you've bought a portable CD player or other low-end electronics item recently. Every store has half a dozen brand-name versions of the same item, with all but identical features and prices. How the heck do you decide? Most people make the Sony decision. How can you go wrong buying a Sony, they ask one another. Everyone carries a Sony. And at the very least it's bound to have a decent warranty, right?

Millions of people follow the same reasoning when buying PCs. And when they walk out with whatever they believe is the PC equivalent of a Sony Discman,

they have no idea if they've bought the right machine, but they feel pretty certain they didn't do anything really stupid. If you'd trade a case of beer just to come out of the process feeling half that good, stick with retail. As for me, pass me another cold one and hand me the telephone.

Shopping the Net for Software

Grand openings in cyberspace

Over the past year, electronic shops have popped up all over the Internet with companies such as FTP, Gupta, and Symantec using them primarily for software distribution. Now IBM, Microsoft, Oracle, and others are experimenting with this method of selling their products.

IBM has opened its Reusable Software Component Market for software developers, and IBM CEO Lou Gerstner has proposed doing away with existing product distribution models altogether as users will be able to upgrade software over the network.

Since January, Oracle has been distributing its WorkGroup 2000 products through its World Wide Web site and has recently

opened the Oracle Store. Microsoft has also jumped in with its recently announced pilot project for electronic distribution of software. "The customer gets product instantly, and we get feedback on our products almost instantly as well," said Laurent Pacalin, senior director of worldwide electronic distribution at Oracle.

Of the two companies, Microsoft has been more cautious. "We were concerned with protecting our intellectual property," said Velle Kolde, group manager for emerging channels at Microsoft. Microsoft also wanted to be sure that proper security was in place before offering a fee-based service. "Although transaction security is actually set up by the reseller, Mi-

crosoft has certain security standards that the reseller has to uphold," Kolde said. While most consumers don't yet have the high-speed connections necessary to make electronic software distribu-

wrapped product shipped to you.

Oracle has been far more focused on electronic offerings, with 125,000 downloads for trials of WorkGroup 2000 since last January. The company's Oracle Store

lets you make a selection, pay for the product, and receive the product within three days. The next step is Object Marketplace, where developers can buy Oracle Power Object Components and OCX controls from Oracle and third-party developers.

The electronic delivery of software may not be for everyone. Based on Microsoft research, first-time purchasers still want to put their hands on the box and all of the documentation.

—Sarah Roberts



tion feasible, Kolde expects this to change rapidly as ISDN becomes more widespread.

In Microsoft's case, you can either download software or order it electronically and have shrink-

ISDN CONNECTIVITY. ANALOG COMPATIBILITY. ONE SOLUTION.



COURIER I-MODEM WITH ISDN/V.34

Expansions in the mobile and telecommuter workforce, an increased need for bandwidth intensive file transfers, Internet access, and LAN-to-LAN connections have all called for faster, more accurate and reliable transmissions. Such communications are easily realized with ISDN. But what if you want to connect with an analog modem or fax machine...will you need to use a separate device? Not anymore! With the Courier I-modem from U.S. Robotics you can do both. Courier I-modem terminal adapter combines ISDN performance with the award-winning U.S. Robotics V.Everything with V.34 analog modem technology. From a single device, Courier I-modem allows you to send or receive data regardless of whether the

remote device is analog, Switched 56K or ISDN. Transition from analog to ISDN occurs transparently with the Courier I-modem because it uses the standard AT command set and requires no special communications software.

U.S. Robotics simplifies your transition to ISDN with the I-Team – a dedicated service and support group that provides information about ISDN tariffing, availability, and provider contacts.

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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

PCs

At 200 MHz, Pentium Pro PCs Challenge Workstations

By Bruce Brown

Pentium Pro PCs are getting faster. Our first group of systems using Intel's new processor (First Looks, December 5, 1995), which consisted of four 150-MHz Pentium Pro-based computers, provided an initial glimpse of how well the new CPU performs. This second round of five Pentium Pro machines picks up where those systems left off by boosting the CPU's speed by one-third and extending the symmetric multiprocessing architecture that is built into the Pentium Pro chip.

The 200-MHz CPUs are built on a sophisticated 0.35-micron semiconductor process, which allows for chip geometries that are 40 percent smaller than those of the 150-MHz version and for faster clock speeds. Both versions have 5.5 million transistors, 16K of internal cache, and 256K of external cache. Except for the speed difference, they act alike.

We tested five Pentium Pro systems from Advanced Logic

Research, Compaq Computer Corp., Gateway 2000, Hewlett-Packard Co., and Micron Electronics. We used an array of 32-bit applications running under Windows NT to gauge how these systems stack up against one another and against the best available workstation technology.

Though the Pentium Pro processor doesn't have an edge on Pentium CPUs on 16-bit operating systems and applications, on tests with 32-bit programs, the Pentium Pro challenges traditional—and much more expensive—workstations, such as the \$27,995 Sun Ultra 1 Creator 3D (First Looks, December 19,

1995). The systems were tested with 64MB of RAM, the appropriate base memory level for Windows NT systems used for graphics applications.

Compared with the 150-MHz Pentium Pro systems, these 200-MHz systems delivered performance that was between 20 percent and 40 percent better. But that was just the start. For the two dual-processing systems (the ALR Evolution Dual6 and the HP Vectra XU 6/200C; see the sidebar), adding a second processor improved performance on those tasks that were multi-threaded, such as Photoshop's

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MEMORY MASTER: The ALR Evolution Dual6 has room for up to 512MB of ECC memory.

DATABASE MANAGEMENT

Paradox 7: Powerful 32-Bit Database Built for Developers

By Sal Ricciardi

The latest release of Borland's Paradox for Windows database management system, the \$299 Paradox 7, is a much-improved product that supports Windows 95 features, is easier to use, and offers more powerful development tools. Still, the new Paradox remains the old Paradox to a great degree.

The program omits improved database metaphors such as the container concept used in other products, and Paradox's once-legendary query facility is still not as easy to learn and use as Microsoft Access's QOBE, for ex-

ample. So if you're looking for a database that has been redesigned from the ground up, keep looking. On the other hand, if you want a powerful 32-bit

Windows 95 or Windows NT development tool with an object-based language, advanced OLE support, and an impressive development environment, Paradox 7 delivers.

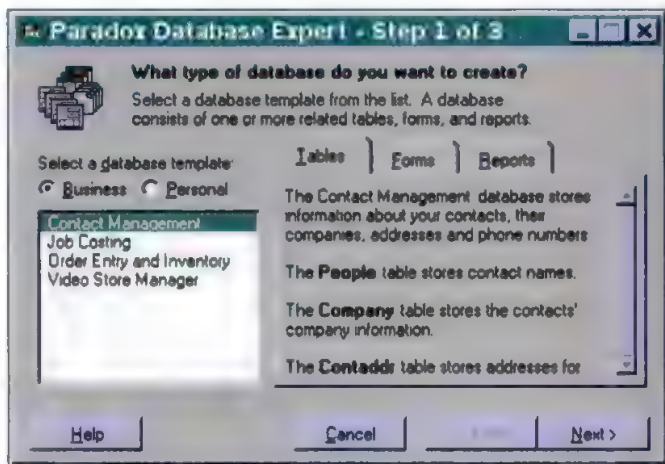
These days, Borland is catering to developers, and this shows in the new version of Paradox. For starters, Borland has taken editor

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DATABASE 101: Paradox's Database Expert helps you build complete applications using a comprehensive list of predefined templates.



Pentium Pro PCs

Continued from page 39

Sharpen Edges function, by an additional 45 percent.

The cost of this dual-CPU kick was seen on tasks that weren't multithreaded, which constitute most of the software available today. Here, performance dropped a little compared with that of single-CPU configurations, because of the second processor's overhead.

Each system had its strengths and weaknesses. The value leader was Gateway 2000's \$6,399 G6-200, which achieved solid though not stellar scores.

At the other extreme was the \$11,326 Vectra XU 6/200C—the most expensive of the five systems but worth the money. The system's 128-bit data path, dual-processing architecture, and Fast SCSI-2 hard disk subsystem combined for blazing results in dual-CPU mode.

At \$8,897, the Micron Pro 200 Magnum Plus is a fully equipped graphics workstation with a 21-inch monitor and a Number Nine Imagine 128 Pro graphics card with 8MB of VRAM.

The \$9,109 Evolution Dual6 works well with two 200-MHz Pentium Pro processors, but its Enhanced IDE hard disk tended to hold this system back.

In order to place these new systems in perspective, we also included a 150-MHz Pentium Pro machine. Compaq's \$8,299 Deskpro XL 6150 Model 1050/CDS, which costs as much as the 200-MHz systems, couldn't match their performance.

Faster Pentium Pro CPUs are in the offing, and AMD and Cyrix are both hot on Intel's trail with competitive CPUs. Expect both CPUs later this year. AMD's K5 is a 4.3-million-transistor, four-way superscalar processor with five execution units, out-of-order processing, and 24K of internal cache. By contrast, the 3.3-million-transistor Cyrix M1 is a two-way processor, like the Pentium. But unlike the Pentium, the M1 supports out-of-order processing, has four execution units

(to the Pentium's three), and 16K of internal cache.

With different designs, these chips are faster on paper than Pentium CPUs, and each provides an alternative to the Pentium Pro.

Though these five Pentium Pro systems won't blow workstations off the race-course yet, they are competitive. And on a price/performance basis, workstation vendors should start nervously looking over their shoulders.

ALR EVOLUTION DUAL6

Based on ALR's own motherboard, the \$9,109 Evolution Dual6 uses two CPU sockets, Intel's 82450KX PCI chip set, and a 64-bit memory path with one-way and two-way memory interleaving. The unit also has expansion capability for up to 512MB of memory error correction code (ECC)—a significant factor in protecting data integrity and vital in mission-critical workstation applications. The Vectra XU 6/200C was the only other tested system with ECC memory.

Housed in a mini-tower case, the system's configuration includes a Matrox Millennium video card with 2MB of Window RAM (WRAM), a 4X Mitsumi CD-ROM drive, and a 17-inch Mag InnoVision monitor. No audio card is included.

On our performance tests, we found that the weak link was the system's Conner 1.2GB Enhanced IDE hard disk. For example, on the Microsoft Excel and Word Macro Script tests, the 200-MHz Evolution Dual6 was only slightly faster than the 150-MHz Compaq Deskpro XL 6150. With a SCSI-2 hard disk, it's likely that the Evolution Dual6's performance would improve.

In addition, the Evolution Dual6 achieved average scores on both the CPUmark₁₆ and CPUmark₃₂ processor tests, as

well as on the Photoshop Lighting Effects test. On the AutoCAD and C++ Compiler tests, the Evolution Dual6 trailed the other 200-MHz systems by as much as 10 seconds.

In dual-processor mode on the multithreaded Photoshop Sharpen Edges task, the Evolution Dual6's second CPU showed its stuff with a 45 percent improvement over results for single-processor mode. But the Evolution Dual6's dual-processor results slightly trailed those of the Vectra XU 6/200C.

ALR's Evolution Dual6 is one of the first systems available with standard support for two Pentium Pro processors, which can help you speed through your work. **ALR Evolution Dual6.** Estimated street price: With two Pentium Pro/200 CPUs, 64MB RAM, 1.2GB hard disk, Matrox Millennium video card, 17-inch monitor, \$9,109. Advanced Logic Research Inc., Irvine, CA; 800-444-4257, 714-581-6770; <http://www.alr.com>. Circle 434 on reader service card.

COMPAQ DESKPRO XL 6150 MODEL 1050/CDS

Compaq's Deskpro XL 6150 Model 1050/CDS is the only 150-MHz Pentium Pro system in this mini-roundup. With a selling price of \$8,299, the Deskpro XL 6150 is expensive in view of its perfor-

mance. Buyers looking for a corporate power-user machine who want the assurance of the Compaq name will find this average performer (when compared with other 150-MHz Pentium Pro computers) an appealing choice.

Packaged in a desktop case, the Deskpro XL 6150 uses Compaq's TriFlex EISA bus motherboard with Intel's 82450GX PCI chip set. The TriFlex chip set is intended for use on servers and supports from one to four CPUs and two PCI buses. Maximum memory on the Compaq's motherboard is 512MB, using dual inline memory modules (DIMMs).

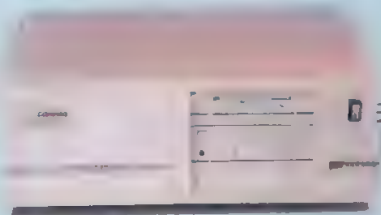
The test system had 64MB of RAM and was configured with an IBM 1GB SCSI-2 hard disk, a Matrox Millennium video card with 4MB of WRAM, a Sanyo 4X CD-ROM drive, and a Compaq 17-inch monitor. The motherboard has integrated FM-synthesis audio, and the system includes a Vocalyst keyboard, which has a single speaker, built-in microphone and volume controls, and headphone, microphone, and mouse connectors. The system also has a 10-megabit-per-second Ethernet interface on the motherboard.

The Deskpro XL 6150 had midrange results compared with the average of the previously tested group of 150-MHz Pentium Pro PCs both on the CPU benchmark tests and on the 32-

FOUR HOT WORKSTATION PCs



SERVER SUBSYSTEM: The Deskpro XL 6150's advanced chip set can accommodate up to four processors and two PCI buses.



TWIN TURBOS: The dual-processor HP Vectra XU 6/200C walked away from the competition on multithreaded tasks.

First Looks



MORE FOR THE MONEY:
The Gateway 2000 G6-200 was the least expensive Pentium Pro PC and turned in respectable performance scores.

GRAPHICS WORKSTATION: The speedy Micron Pro 200 Magnum Plus features an Imagine 128 Pro card and a 21-inch monitor.



bit applications tests. The only test on which the unit's scores stood out was the Microsoft Excel Macro Script test: The Deskpro XL 6150 performed about 10 percent faster than the average 150-MHz Pentium Pro.

The Deskpro XL 6150's quality components, including the up-scale Intel chip set and high memory capacity, will make this a high-profile system in the eyes of corporate system buyers.

Compaq Deskpro XL 6150 Model 1050/CDS. List price: With Pentium Pro/150 CPU, 64MB RAM, 1GB hard disk, Matrox Millennium video card, 17-inch monitor, \$8,299. Compaq Computer Corp., Houston, TX; 800-345-1518; fax, 713-518-1442; <http://www.compaq.com>. Circle 435 on reader service card.

GATEWAY 2000 G6-200

The Gateway 2000 G6-200 demonstrates that value and performance are not mutually exclusive terms when you build a PC around standard components. Based on the Intel motherboard and Intel's 82450KX PCI chip set, the single-processor 200-MHz Pentium Pro G6-200 costs \$6,399 for a fully configured system.

Positioned as a Windows NT workstation and a high-end desktop PC, the G6-200's Intel motherboard has a 32-bit memory path and is limited to 128MB

of RAM. This may seem like a lot for a desktop system, but can be tight for a workstation.

Packed inside a full tower case, the G6-200 as tested was configured with 64MB of RAM, a Seagate 2GB SCSI-2 hard disk, a Matrox Millennium video card with 4MB of WRAM, and a 17-inch Gateway CrystalScan monitor; a \$100 option will get you a Sony-made Gateway Vivitron monitor of the same

screen size. There is no audio card standard with this system, but a Wearnes 6X CD-ROM drive is included, as is Microsoft Office 95 Professional Edition.

Processor-test scores don't usu-

ally vary much from machine to machine, but the G6-200, the only system to use an Intel motherboard on these tests, had the lowest CPUmark₃₂ score. On our applications tests, the G6-200 did a fine job and was in the thick of things with the more expensive 200-MHz Pentium Pro machines. The G6-200 attained the second-fastest score on the Microsoft Excel Macro Script test in this tightly grouped bunch.

Although it's not the fastest 200-MHz Pentium Pro system available and it accommodates only a single CPU, the Gateway 2000 G6-200 is the bargain system of this high-end group. Average performance, fine components, and a high-powered software suite make the G6-200 an excellent choice for the budget-minded power user.

Gateway 2000 G6-200. List price: With Pentium Pro/200 CPU, 64MB RAM, 2GB hard disk, Matrox Millennium video card,

17-inch monitor, \$6,399. Gateway 2000 Inc., North Sioux City, SD; 800-846-2000, 605-232-2000; fax, 605-232-2023. Circle 436 on reader service card.

HP VECTRA XU 6/200C

Hewlett-Packard Co.'s Vectra XU 6/200C, which sells for \$11,326, is the most costly, but it's also the most powerful dual-processor 200-MHz Pentium Pro system we've seen. Using HP's own motherboard design with an innovative 128-bit memory path and ECC memory for data integrity, the Vectra XU 6/200C is based on DIMMs with a system maximum of 256MB. The Evolution Dual6 was the only other PC in this miniroundup that came with ECC memory.

The Vectra XU 6/200C comes in a full tower case with air scoops that look like vacuum-cleaner parts to direct airflow for efficient cooling. The test system was configured with

PERFORMANCE TESTS



Pentium Pro PCs

The all-out winner of the single-processor contest was the Micron Pro 200 Magnum Plus, which achieved top scores on five of our seven tests. As for the dual-CPU

systems, the HP Vectra XU 6/200C set the pace and came close to the Sun Ultra 1 Creator 3D Model 170E's top score on the AutoCAD test.

Each system was equipped with 64MB of RAM.

▼ Lower scores represent better performance
▲ Higher scores represent better performance
Red type denotes first place among PCs reviewed

	Excel Macro Script (seconds)	Word Macro Script (seconds)	CPUmark ₁₆	CPUmark ₃₂	AutoCAD (min:sec)	Photoshop Lighting Effects (seconds)	C++ Compiler (min:sec)
ALR Evolution Dual6 (one 200-MHz CPU)	35.5	26.2	358	561	3:08	29.1	2:03
ALR Evolution Dual6 (two 200-MHz CPUs)	31.9	25.9	N/A	N/A	3:01	28.1	2:01
Compaq Deskpro XL 6150 Model 2100/CDS (one 150-MHz CPU)	37.6	27.0	270	429	3:56	38.7	2:26
Gateway 2000 G6-200 (one 200-MHz CPU)	27.8	22.9	387	511	3:47	29.0	1:59
HP Vectra XU 6/200C (one 200-MHz CPU)	28.9	22.1	360	568	3:41	29.0	1:54
HP Vectra XU 6/200C (two 200-MHz CPUs)	26.0	21.2	N/A	N/A	3:36	28.9	1:53
Micron Pro 200 Magnum Plus (one 200-MHz CPU)	27.7	20.7	388	571	2:55	27.4	1:51
Sun Ultra 1 Creator 3D Model 170E (one 167-MHz CPU, First Looks, 12/19/95)*	145.1	82.2	N/A	N/A	2:27	47.7	1:01
Average Pentium Pro 150 (First Looks, 12/5/95)*	42.1	26.9	270	408	4:05	39.2	N/A ¹

* Reported for comparison. N/A¹—Not applicable. CPUmark processor tests are not multithreaded. N/A²—Not applicable. CPUmark processor tests do not run on Solaris. N/A³—Not applicable. We did not run this test for that story.

MICROSOFT EXCEL AND MICROSOFT WORD MACRO SCRIPTS

We used test scripts that exercise a wide variety of system functions that mirror real-world activities. Functions such as spell-checking, font changes, copies, deletes, repaginations, and print previews are performed in the Word script. Operations such as recals, statistical functions, cuts and pastes, and charting are performed in the Excel script.

CPUmark₁₆ AND CPUmark₃₂

These tests each provide an indication of a system's ability to perform computationally intense tasks in 16-bit and 32-bit operating systems, respectively.

AUTOCAD

The AutoCAD test stresses a system's CPU and ability to paint complicated graphics. There are three key areas of our AutoCAD test script: opening 2-D and 3-D drawings, performing 2-D

manipulations, and performing 3-D manipulations.

ADOBE PHOTOSHOP LIGHTING EFFECTS

We use the Lighting Effects filter within Photoshop to see how the systems handle complicated graphics tasks.

C++ COMPILER

This test compiles a large source-code file in Symantec Corp.'s 32-bit C++ compiler.

First Looks

64MB of RAM, a Seagate 2GB SCSI-2 hard disk, a Matrox Millennium video card with 2MB of VRAM, and a 17-inch HP monitor. A Sony 4X CD-ROM drive is standard, and a Creative Labs Vibra 16 FM-synthesis audio chip is integrated onto the motherboard with a convenient volume control on the case front. An HP Ethernet card is also included.

The Vectra XU 6/200C performed extremely well in single-processor mode, in second place on the whole behind the speedy Micron Pro 200. In dual-processor mode, however, the Vectra XU 6/200C walked away from the pack, with a 45 percent performance improvement over single-processor mode on the Photoshop task using the multithreaded Sharpen Edges function.

The HP Vectra XU 6/200C combines top performance with the most advanced technology of the tested systems. If your application requires fast execution of

multithreaded applications and if you are looking for a durable, well-designed, and speedy Pentium Pro for a 32-bit operating system, the HP Vectra XU 6/200C is a leading choice.

HP Vectra XU 6/200C. Estimated street price: With two Pentium Pro/200 CPUs, 64MB RAM, 2GB hard disk, Matrox Millennium video card, 17-inch monitor, \$11,326. Hewlett-Packard Co., Palo Alto, CA; 800-752-0900, 303-635-1000; <http://www.hp.com>. Circle 437 on reader service card.

MICRON PRO 200 MAGNUM PLUS Micron Electronics' \$8,897 Pro 200 Magnum Plus was easily the most powerful single-CPU computer of this high-flying group. With the fastest times on five of our seven benchmark tests, the Pro 200 shows the potential of Intel's hot processor.

Based on a Micronics motherboard in a mini-tower case, the Pro 200 is configured and positioned as a high-end graphics sys-

tem for desktop publishing and CAD-CAM applications. The test system was configured with 64MB of RAM, a Quantum 2GB SCSI-2 hard disk, a Plextor 6X CD-ROM drive, and a Creative Labs Sound Blaster AWE32 audio card with FM-synthesis and wavetable sound. Advent AV270G Powered Partner speakers provide strong sound for multimedia. Microsoft Office 95 is also included.

Some of the Pro 200's great performance can be attributed to its powerful Number Nine Imagine 128 Pro graphics video card, packed with 8MB of VRAM. True to its graphics positioning, the Pro 200 comes with a 21-inch Hitachi monitor; downgrading to a 17-inch monitor saves \$1,350.

The Pro 200's performance numbers speak for themselves. This is a fast machine, even for a 200-MHz Pentium Pro system. On the whole, the system was the top performer on five of our seven benchmark tests. The

most telling number is the CPUmark₃₂ score, which, while only slightly higher than the Vectra XU 6/200C's next-highest score, sets the pace for the system. At 25 seconds, the system's score on the Microsoft Excel Macro Script test led that of the G6-200 (the next-best score) by nearly 10 percent.

Pentium Pro systems are new to the market, and hot video cards and hard disks, memory configurations, and caching techniques will most likely appear to push performance to the limit. For single-processor 200-MHz Pentium Pro systems, the Micron Pro 200 Magnum Plus is the workstation to beat.

Micron Pro 200 Magnum Plus. List price: With Pentium Pro/200 CPU, 64MB RAM, 2GB hard disk, Number Nine Imagine 128 Pro video card, 21-inch monitor, \$8,897. Micron Electronics Inc., Nampa, ID; 800-388-6334, 208-463-3434; fax, 208-463-3424. Circle 438 on reader service card.

Symmetric Multiprocessing: Almost Double Your Power

Deep down, all Pentium Pro processors have what it takes to work with more than one CPU. The processor's external cache, which is contained on a module with the CPU, maintains individual processor/cache coherency and the Intel MPS (MultiProcessor Specification) supports up to four-way symmetric multiprocessing (SMP). With all the necessary internal logic to work with as many as four processors in the same system, SMP is ready to come out of the server closet and join the mainstream desktop market.

Two Intel PCI Pentium Pro chip sets are available now. The 82450KX supports single- or dual-processor motherboards, and the 82450GX supports up to four processors and two PCI buses. To work with more than four processors, either the processors' built-in external L2 caches will need to be larger than 256K or an off-chip external cache will be necessary.

The ALR Evolution Dual6 and the HP Vectra XU 6/200C each support two 200-MHz Pentium Pro processors and give a peek at the advantages of multiple processors sharing the workload. As PC Labs testing showed, running a nonmultithreaded application such as the Microsoft Excel and Word Macro Script tests results in slower performance than running the same tests on the same

system with only one processor active. The overhead of maintaining the second processor uses valuable time, and the second processor just sits there doing nothing of benefit.

When running a multithreaded application, however, such as Photoshop's Sharpen Edges filter, dual-processor test results

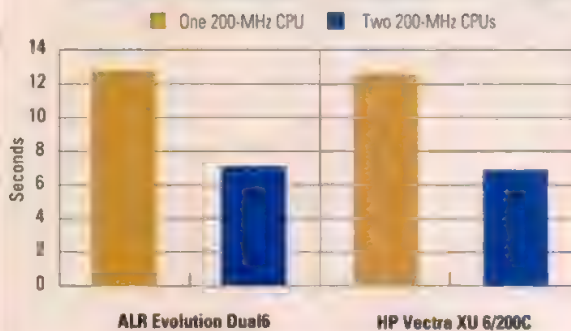
showed a 45 percent improvement compared with single-processor results on both systems. In competitive and high-pressured graphics work settings, where multithreaded applications are common and where saved production time translates easily into bottom-line savings, dual-processor machines will quickly earn their keep.

Another benefit of a dual-processor system is in multitasking. In the event that you run

multiple applications simultaneously, a dual-processor Pentium Pro system automatically shares the load, whether you are running DOS, 16-bit, or 32-bit single- or multithreaded applications.

The extra \$1,400 or so that the second Pentium Pro processor costs will keep many wallets closed, but the Pentium Pro makes it very simple for those who multitask or run multithreaded applications to get a big performance boost for a comparatively small amount of cash.—BB

Dual-Processor Pentium Pro PCs



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*Maximum capacity using 2:1 data compression

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Paradox 7

Continued from page 39

technology from Borland C++ and Delphi and put it into the ObjectPAL editor. The program introduces such features as color syntax highlighting; indenting and outdenting; several levels of undo and redo; keyboard mapping for CUA, Brief, or Epsilon; changeable fonts; and bookmarks. Add this to Paradox's highly capable design, development, and debugging lineup and you have a complete database environment.

EXPERT ASSISTANCE

For end users, the most noticeable change in Paradox 7 is its vastly improved Experts. Like Microsoft's Wizards, the Experts walk you through certain tasks within Paradox. For example, start Paradox and you'll be greeted with the Startup Expert, which helps you create a new database from scratch, open one you've already created, or generate a new one using the new Database Expert. What's neat about the Database Expert is that it creates complete applications, including tables, forms, and reports, from predefined templates.

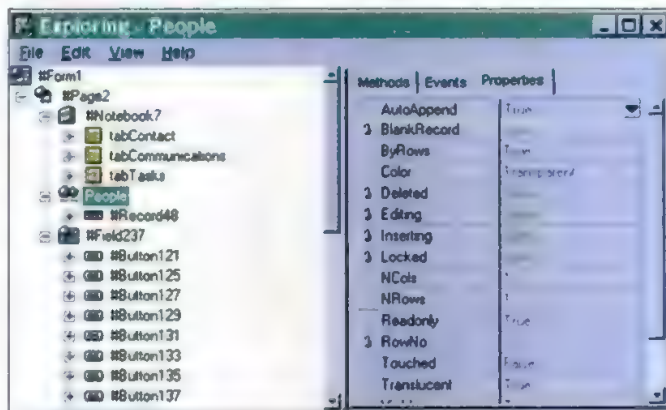
Among the templates is an interesting multitable business contact manager that uses a tabbed interface and an eight-table video store manager for tracking rentals. We liked the multitable examples because they illustrate design techniques for novices studying database design as well as advanced graphical features such as tabbed pages (Paradox calls them "notebook pages").

Other Experts create tables and charts and perform mail-merges and text importing. There is also an Expert for creating Form buttons that automatically generates the button and the attached code for you.

For optional special effects such as shading,

Paradox includes a Text Expert. An Application Launcher bundles all of your elements—forms, reports, tables, and queries—into one tabbed window. Finally, if you get tired of the Experts, Para-

office suites such as Microsoft Office and Novell's PerfectOffice. For example, you can use the ObjectPAL programming language to execute methods and access properties of OLE server appli-



OBJECT ORGANIZER: The Object Explorer lets you perform a variety of functions, such as inspecting a container's object tree and editing methods, events, and properties all in one window.

dox lets you turn the Experts off.

Once you've created applications, Paradox 7 helps you edit them, thanks to an ingenious new Object Explorer, which lets you easily navigate a container's object tree and inspect methods, events, and properties. You can quickly locate and edit code or change property settings, because everything is located in one place and well organized. We liked the Object Explorer's use of Windows 95-style visual elements, such as an expandable outline and tabbed display.

There are also some SQL enhancements in Paradox 7 (the program comes with a coupon for the limited-license 32-bit version of SQL Links that is scheduled to ship in early 1996). You can now use SQL tables directly instead of having to invoke the SQL Tools menu. The SQL Editor benefits from all the same enhancements as the ObjectPAL editor.

Paradox 7 is an OLE client and server, which enables a higher level of integration between Paradox and other OLE applications, especially

calculations, such as Microsoft Word. In addition, Paradox is now itself an OLE server, and OLE clients such as Microsoft Excel or Visual Basic can call methods and access properties exposed by Paradox.

Also new to this release is support for 16-bit and 32-bit .OCX (OLE 2.0) controls, which allow third-party developers to extend Paradox's capabilities and provide new features. The CD-ROM version includes several sample .OCX custom controls.

A number of new native Windows 95 controls have been added to Paradox as well, including a Combobox, Listbox, Progress Bar, Spinbox, and Trackbar. You'll also find a series of new ObjectPAL methods for dealing with toolbars, MAPI mail, .OCX controls, and OLE automation.

The new Paradox supports such Windows 95 features as long filenames, common dialog boxes, and tabbed property sheets. It is also tightly integrated with the Windows 95 Explorer—even more so than Microsoft's own database product, Access. For example, if you bring up a Form's Context menu (highlight the Paradox Form file in the Explorer and right-click), Paradox displays options to open, design,

copy, rename, or delete the Form. Do the same with a Paradox table and you'll get an even longer list of choices. Unlike with Access, you can't drag-and-drop Paradox objects to the desktop to create shortcuts.

Paradox's on-line help has been dramatically improved. If you buy the CD-ROM version, you'll get Paradox's CD Quick Tour, an animated introduction to the product's new features. Borland plans a Paradox for Windows Client/Server Edition for developers.

In addition, there will also be Microsoft Office or PerfectOffice toolbars that include a button for launching Paradox; they should be available for downloading from CompuServe or Borland's World-Wide Web site by the time you read this. As of this writing, plans to bundle Paradox 7 in Novell's PerfectOffice suite are on hold because of Novell's intentions to sell the division.

ROOM FOR IMPROVEMENT

So what's missing? Paradox sorely needs a logical conceptual approach to a database, such as the unified database container in Access. Also, Paradox's QBE facility is falling behind the times: It lacks two-way SQL support and a Query-By-Form feature like the one in Access or Lotus Approach. Despite many enhancements, Paradox is still not as easy to use as Access or Approach.

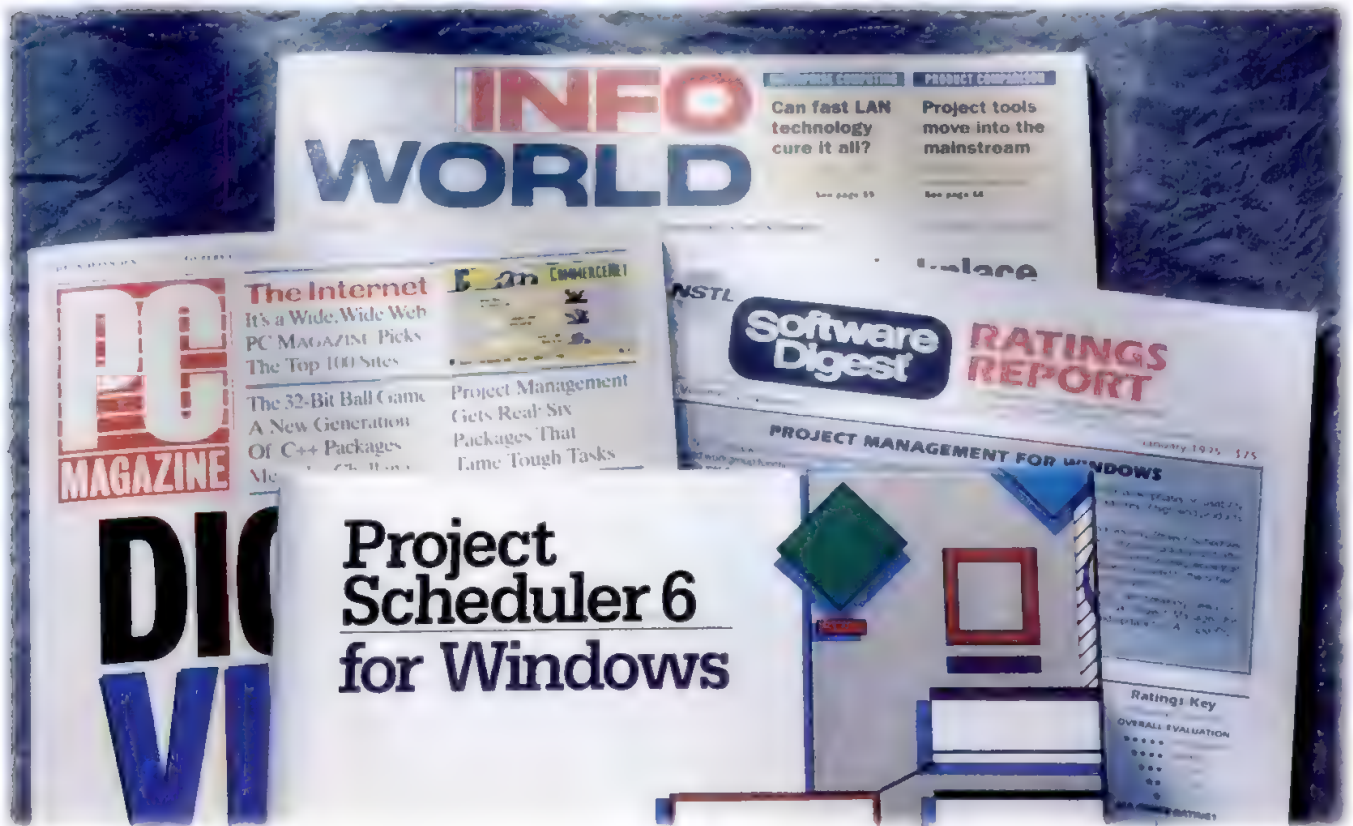
Even with these shortcomings, the new Paradox fits well into the Windows 95 world, especially if you're already a Paradox developer. Given the complexity of developing Windows applications these days, Paradox's object-oriented development environment and tools are inviting.

Paradox 7 for Windows 95 & Windows NT. Estimated street price: \$299; upgrade, \$89. Requires: 8MB RAM (12MB RAM for Windows NT), 13MB hard disk space, Microsoft Windows 95 or Windows NT. Borland International Inc., Scotts Valley, CA; 800-233-2444, 408-431-1000; <http://www.borland.com>. Circle 433 on reader service card.

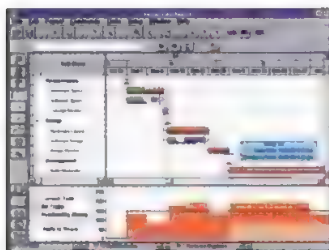


From January 22 to 26, go on-line to discuss Borland's Paradox 7 for Windows 95 with product manager Fred Felman and Sal Ricciardi, a contributing editor of PC Magazine. Type GO EXEC at any CompuServe prompt.

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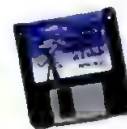


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INSTRUMENTS**

INTERNET SOFTWARE

Windows Newsreaders: All the News That's Sent in Bits

By Neil Randall

The World-Wide Web has captured all the on-line glory, but Usenet newsgroups still account for a lot of the Internet traffic. They're also the focus of most of the controversy surrounding the Internet; the Communications Decency Act was largely about pornography and salacious chats on newsgroups. Still, newsgroups serve a purpose for social and professional communication, and to make the most of them you need a good newsreader.

fourth kind of newsreader is your Web browser itself.

VALUE JUDGMENTS

Newsreaders should be judged on several factors: their ability to display threads, their options for posting messages, and their ease at decoding and saving attached binary files. Newsgroup discussions occur in threads, which consist of the original message and all its replies. The more clearly a newsreader displays these threads, the more effective it can be.

Subscribed Groups, and Folders (which you create yourself). For even better efficiency, you can tell the program to "watch" or "ignore" specific threads, helping you focus on only what's most interesting or important.

Agent can be used as an off-line reader by programming it to log-on and check your subscribed newsgroups automatically. Agent doubles as an e-mail client; you can send and receive e-mail messages and filter them into the program's folders.

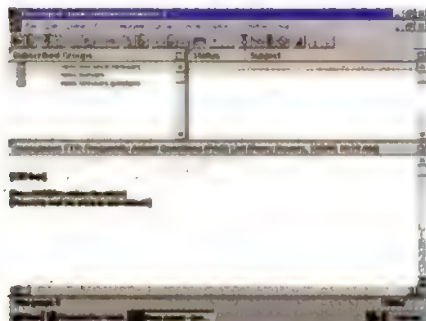
Agent displays threads well enough, through a system of folder-like arrow icons, but it could benefit from better differentiation between main subjects and threads by using different colors, fonts, or indentation. Fortunately,

e-mail client. Neither program is available as a standalone client.

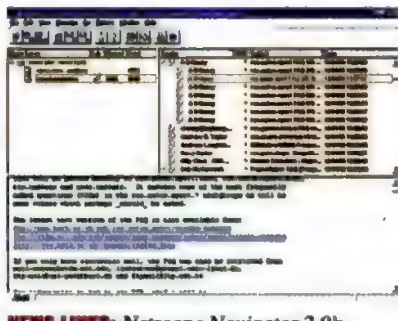
QMC is more adept at e-mail than newsreading. The program doesn't do a good job of distinguishing between threads; its posting and replying features are exemplary, however. QMC offers uu-decoding, but the process is complex. In the case of a multipart binary attachment, you must highlight all parts of the file, mark them to be retrieved, and then save the files.

By contrast, Comm Suite 95 is much stronger as a binary decoding tool and a viewer of newsgroup threads. With the View Threads feature activated, a small Threads window appears with each posting you select; you can select an item with-

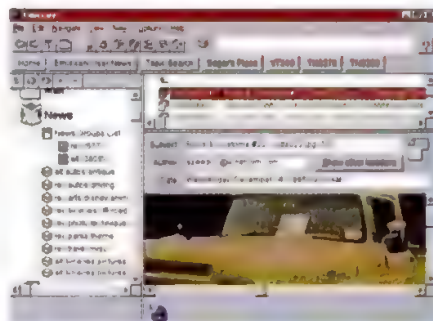
EXTRA! EXTRA! READ ALL ABOUT IT...



DOUBLE AGENT: Forte's Agent—and the free-ware version, Free Agent—are full-featured newsreaders that double as e-mail clients.



NEWS LINKS: Netscape Navigator 2.0's newsgroups messages are easy to read and include dynamic links to any associated uniform resource locators (URLs).



ONE-STEP DECODING: Double-click on a binary file and Emissary's newsreader automatically decodes and displays the image.

To keep up with the dizzying pace of the Internet, where the best programs change daily, this roundup includes a mix of released and developmental software.

For Windows users, newsreaders come in four flavors. Some are standalone clients, such as Forte's Agent .99b.

Others come as separate apps within Internet suites. Delrina Corp.'s Cyberjack for Windows 95, Version 7.0 (which will be packaged with Delrina Comm Suite 95) and Quarterdeck Corp.'s Message Center 1.0 (included with InternetSuite for Windows 1.0) are prime examples.

Still others are built into fully integrated Internet apps, such as Wollongong's Emissary 1.0. The

But newsgroup members also are concerned with posting and replying to messages, and options here are important as well. Finally, the most advanced newsreaders can handle uu-decoding transparently.

Agent .99b, from Forte, is a rare breed: a commercial standalone newsreader for Windows users. Available in both 16-bit and 32-bit versions, Agent's features are formidable: automatic decoding, extensive threading, and good customizability. Free Agent, a freeware version, can be downloaded from Forte's Web site.

The full commercial version of Agent offers four views of newsgroups: All Groups, New Groups,

ly, you can easily expand or collapse all or selected threads. Agent shines in the retrieval of binary files, even multipart files. Right-click on any part of the file, select Save Binary Attachments, and the program will find the remaining portions and then decode and save the binary to the appropriate directory.

PACKAGE DEALS

Delrina's still-unreleased Comm Suite 95 and Quarterdeck's Message Center 1.0 (QMC) both offer a solid list of features. Of the two, Comm Suite 95 is easier to use when it comes to uu-decoding of files and somewhat better for viewing threads. But QMC is both an advanced newsreader and

in that thread from the small window. To decode a binary file and save it to your hard disk, you need only click on the first posting in a multipart thread, choose Select Multipart from the Edit menu, then right-click and select Decode to Disk. On the whole, the program is a good but somewhat limited reader that will appeal to newcomers, but newsgroup veterans might find it too simplistic.

A strong newsreader is built right into the most fully integrated Internet package, Wollongong's Emissary. You can switch effortlessly from Web browsing to reading mail or news by clicking on the News icon in the program's "tree" on the left side. Further, URLs in

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First Looks

an e-mail message or news posting appear as underlined hyperlinks, and clicking on them takes you back to the Web browser. Emissary's newsreader is easy to follow and comfortable for novices and veterans alike, and its automatic decoding is the strongest of all the readers we examined.

Emissary was the first reader to offer not just automatic decoding of binaries, but automatic viewing as well. (Netscape Navigator 2.0 is the only other reader to offer both features). When you see a multipart binary posting—Emissary makes them easier to locate than most readers—simply double-click on the first parts and wait. Emissary will retrieve the parts in order, uu-decode them, and then display them in the bottom-right window, as long as the file is of a type that Emissary can display (such as the commonly used .GIF and .JPG formats). For other file types, Emissary can be configured to launch an external viewer.

BEYOND BROWSING

Until recently, Web browsers such as NCSA Mosaic and Netscape Navigator offered only rudimentary newsreading, although earlier versions of Navigator did provide excellent viewing of threads. Navigator 2.0, however, follows Emissary's lead as a full-featured newsreader with automatic decoding and viewing of binaries. Subject threads are still displayed clearly, and clicking on a binary upload, or the first article in a multipart posting, prompts Navigator to decode and display the binary (or launch the associated program).

Navigator 2.0 loads a new browser window to accommodate its newsgroups and another to display e-mail (Version 2.0 lets you receive and send e-mail). When a URL appears in a newsgroup or e-mail message, clicking on it opens that URL within the current window (not the original browser window).

Like Emissary, Navigator has become a fully integrated Internet package that will make you reconsider your newsreading strategies.

Which newsreader is best? For ease of use, Emissary 1.0 or Navigator 2.0 win hands down. For full newsreading options, Agent .99b is the clear choice. In any event, the good news is that top-quality newsreading is no longer restricted to the vagaries of Unix's `rn` or `trn`. **Agent .99b.** List price: \$29 (downloaded version) or \$40, plus shipping and handling (with program disks and documentation). Requires: 4MB RAM, 10MB hard disk space, Microsoft Windows 3.1 or later. Forte Inc., Carlsbad, CA; 619-431-6496; <http://www.forteinc.com/forte/>. *Circle 420 on reader service card.*

Delrina Comm Suite 95. Estimated street price: \$99. Requires: 8MB RAM, 15MB hard disk space, Microsoft Windows 95. Symantec Corp., Delrina Group, Toronto,

Ontario, Canada; 800-268-6082, 416-441-7294; <http://www.delrina.com>. *Circle 421 on reader service card.*

InternetSuite for Windows 1.0. List price: \$59.95. Requires: 4MB RAM, 10MB hard disk space, Microsoft Windows 3.1 or later. Quarterdeck Corp., Santa Monica, CA; 800-354-3222, 310-392-9851; <http://www.qdeck.com>. *Circle 422 on reader service card.*

Emissary 1.0. List price: \$99. Requires: 4MB RAM, 4MB hard disk space, Microsoft Windows NT or Windows 3.1 or later. The Wollongong Group Inc., Palo Alto, CA; 800-872-8649, 415-962-7100; <http://www.twg.com>. *Circle 423 on reader service card.*

Netscape Navigator 2.0. List price: \$49. Requires: 4MB RAM, 2MB hard disk space, Microsoft Windows 3.1 or later. Netscape Communications Corp., Mountain View, CA; 415-528-2555; <http://www.netscape.com>. *Circle 424 on reader service card.*

NETWORKING

Digital's Workgroup Web Makes It Easy to Spin An Internal Web for Your Company

By Deval Shah

Digital Equipment Corp. has combined the concepts of the World-Wide Web and workgroups in Workgroup Web 1.0—a program that builds an internal web, or Intranet, for document sharing and conferencing. Because Workgroup Web uses a Web browser, it will be immediately accessible to most users. The product comes in single-user and ten-user packages with list prices of \$99 and \$799, respectively.

One of most important aspects of Workgroup Web is that it lets you create this internal web without a workgroup expert or system administrator. Any member of a workgroup can set up this product, and a Web server isn't even required to use it. The only requirements are that the workgroup shares an underlying domain and that every client has Workgroup Web installed.

Installation is simple, and the only decision to make is which browser you will use. If you choose Workgroup Web's native product, Enhanced Mosaic, in-

Windows NT, integrating Workgroup Web will require some minor tweaking.

When you start the application, the product presents an HTML document for getting started, exploring a sample web, or learning more about the product. Workgroup Web provides a set of tools to create and add documents and folders. It lets you organize everything into folders, and each folder can contain several documents that are being shared. If

you are connected to the Internet, you can include URL links in your Web pages. This manner of organization allows every team member access to all topics.

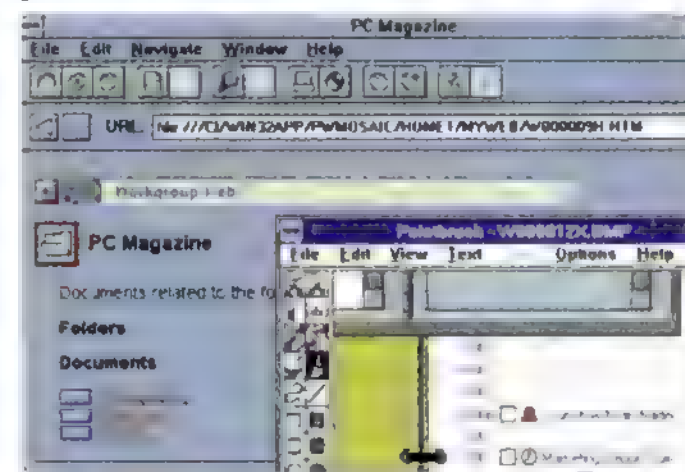
The team can also generate a discussion area based on a document or a URL. Adding docu-

ments to your web is simple: Click on the Add button on the toolbar and you're prompted to provide the path for the document. Workgroup Web creates the link to the document, so that the other members of the team have easy access to the files. Each time someone adds a document or a URL link to the web, Workgroup Web records the time the document was added and who added it.

Workgroup Web's on-line help is simple, clear, and full of screen images that leave little room for confusion. But there is a good chance that you may never need on-line help.

With Workgroup Web, your team will be sharing files and holding on-line discussions in no time.

Workgroup Web 1.0. List price: single-user package, \$99; ten-user package, \$799. Requires: 8MB RAM, 5MB hard disk space, Microsoft Windows 95, Windows for Workgroups, Windows 3.1. Digital Equipment Corp., Littleton, MA; 800-344-4825; <http://www.digital.com>. *Circle 425 on reader service card.*



OFFICE SURFER: Workgroup Web's browser allows you to locate and view files quickly.

stallation is even easier. But you can also use Netscape Navigator or any other browser. On Windows 3.1 or Windows for Workgroups, the integration of other browsers was a breeze. But if you are using a third-party browser with Windows 95 or

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PC Magazine, October 10, 1995



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CIRCLE 004 ON READER SERVICE CARD

ILLUSTRATION

Dabbler 2 Packs High-End Features, Easygoing Interface

By Luisa Simone

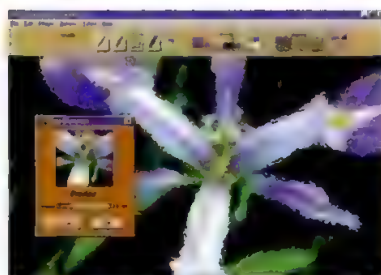
If you are searching for an entry-level painting program that is both low-cost and high-powered, look no further than Dabbler 2, from Fractal Design Corp. This \$69 program—a subset of the company's flagship, Fractal Design Painter—provides a basic selection of Natural Media painting tools and special-effects filters at a bargain price.

For example, Dabbler supplies 12 standard painting tools, such as pencils, chalk, crayons, and oil paints that interact with paper textures, mimicking their real-world counterparts. So oil paints blend with each other and chalk picks up the grain of the paper.

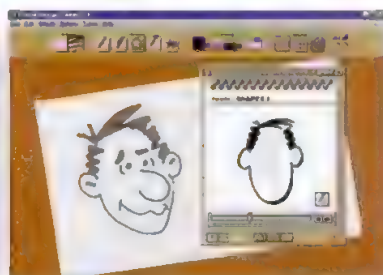
These traditional media are supplemented with a handful of digital functions that are high-end but easy to use. You can now control special effects—such as glass distortion, motion blur, and texturize—with dialog boxes that provide slider bars and preview windows. Dabbler's electronic tracing paper and cloning functions let you quickly transform an imported, scanned picture into a hand-painted work of art.

Some of Painter's new multimedia functionality, specifically the ability to produce so-called flipbooks, has trickled down to Dabbler. Again, Dabbler mimics traditional animation techniques, which means that you must redraw each frame of a flipbook through multiple layers of digital tracing

paper (or onionskin). The flipbooks can be played internally, printed to paper, or exported as .AVI or Quicktime movies.



PAINTING POWER: Dabbler's special-effects window allows you to adjust the strength of a filter interactively.



ART TEACHER: Dabbler's multimedia tutorials talk you through the fundamentals, step-by-step.

There are limitations to this beginners' painting program. You have very few configuration options for the tools. For example, brushes are limited to five predetermined sizes. And Dabbler's selection tools are 1-bit stencils that can't be resized or feathered.

Instead of presenting you with static words and pictures, Dabbler's tutors use sound and motion to explain drawing, cartooning, and animation techniques.

Dabbler is a CD-only product, which allows Fractal to ship the Windows 3.1, Windows 95, Macintosh, and Power Macintosh ver-

sions of the program together. It also provides space for extras—including 100 stock photographs from PhotoDisc, 300 stencils, over 120 paper textures, and fun picture fonts.

The two functions that would unquestionably make Dabbler an incredible value for small-business users—Twain compliance and support of the Adobe Plug-in specification—simply do not work. Fractal Design is aware of these problems and promises a fix in early 1996. Still, Dabbler 2 earns a solid recommendation for its impressive painting features at a low price.

Dabbler 2. List price: \$69. Requires: 8MB RAM, 10MB hard disk space, Microsoft Windows 95 or Windows 3.1, CD-ROM drive. Fractal Design Corp., Aptos, CA; 800-297-2665, 408-688-5300; fax, 408-688-8836. Circle 418 on reader service card.

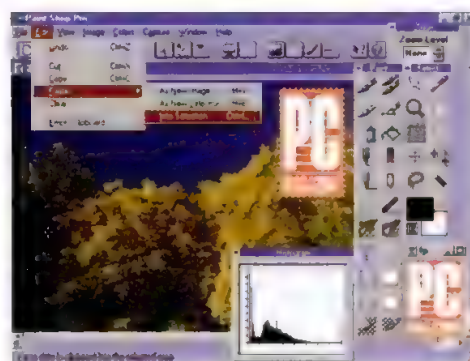
ILLUSTRATION

Paint Shop Pro: 32-Bit-Image Clearinghouse

By J.W. Olsen

With Version 3.12, JASC's \$69 Paint Shop Pro (PSP), image-capturing, editing, and format-conversion utility enters the 32-bit world. Its speed, reliability, and price are attractive, but the program does not offer the tight Windows 95 shell integration of Inset's HiJaak for Windows 95 (First Looks, December 19, 1995) or much new functionality beyond PSP's 16-bit Version 3.0.

Paint Shop Pro now ships with 16-bit and 32-bit versions in the box. We tested the 32-bit version under Windows 95. To its credit, PSP easily surpassed HiJaak by factors of three to six times on informal speed trials. It was also somewhat faster than PSP 3.0 in loading files from disk, but surprisingly, it was slightly slower in screen captures. Unlike HiJaak, PSP lets you work on multiple files in individual MDI windows.



AT YOUR FINGERTIPS: Paint Shop Pro provides quick and flexible access to diverse imaging functions.

PSP maintains the diverse capturing, conversion, and image-editing functions of Version 3.0 but offers only nodding acknowledgment to Windows 95. Though HiJaak is well integrated enough into the shell to permit you to work on files from the Explorer, PSP's Windows 95 functionality is limited to long

filenames, the Recycle Bin, and the uninstaller.

Unfortunately, Paint Shop Pro fails to adapt when switching the screen resolution on the fly. You must save open images, then reopen them under the new resolution.

For basic image capturing, conversion, and editing, Paint Shop Pro's

lightning speed and price paint a pretty picture.

Paint Shop Pro 3.12. List price: \$69. Requires: 4MB RAM, 4MB hard disk space, Microsoft Windows 3.1 or later, Windows 95, Windows NT. JASC, Minnetonka, MN; 800-622-2793, 612-930-9171; <http://www.JASC.com>. Circle 419 on reader service card.

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While each Meridian product is distinct, they all have several intelligent features that set them apart. All include local bus video; an 84-key keyboard with a comfortable palm rest and integrated TruePoint™ pointing device; and the most solid construction available.

Meridian 400 Subnotebook



"ZEOS is out to prove that good things do come in small packages with its Meridian 400C subnotebook," reported *Windows Magazine*.

At 3.9 pounds, the Meridian 400 is molded with a special carbon-fiber material that cuts weight and improves durability. And with a DX4-100MHz processor *standard*, it may well be the highest performance subnotebook available; "faster than a speeding desktop" is how *Computer Shopper* described it.

In addition to great performance, you also get hard drives to 350MB, RAM that's user-upgradable to 20MB, two Type II PCMCIA slots, an external ultra-light 3.5" 1.44MB floppy drive (included in Packages 2 and 3) and your choice of active matrix or dual scan color screens. Amazing!

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"The 800A notebook offers sleek styling, solid construction and hot performance.... one of the fastest notebooks we've ever tested," said *Windows Magazine*.

At 6.3 pounds, the Meridian 800 full-size notebook is light enough to travel anywhere yet, with its whopping 9.5" active matrix color display, is large enough to use for presentations and everyday computing.

To complete the package, you also get a DX4-100MHz CPU, up to 20MB of user-upgradable RAM, a removable hard drive to 810MB, a built-in 3.5" 1.44MB floppy drive and PCMCIA slots supporting two Type II or one Type III devices. Full desktop features that fit in your briefcase!

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DX4-100	\$1495	\$2695	DX4-100	\$1795	\$2895	DX4-100	CNI! \$2095	CNI! \$3195
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75MHz	\$2895		75MHz	\$3395		75MHz	\$3795	
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PDA

HP OmniGo 100 Holds a Pocketful of Portable Data

By Alfred Poor

There's a new Omni in the constellation of Hewlett-Packard Co. computing products, though this one is the smallest of them all. The OmniGo 100 is a hand-held organizer with an estimated street price of \$349, designed to be a flexible PDA (personal digital assistant) for mobile knowledge-workers.

The OmniGo has many features that make it look innovative alongside the BOSSES and Wizard organizers, but PC-compatibility is not one of them. The OmniGo, which is based on the GEOS operating system, doesn't run PC programs, but there is an optional \$119.95 Connectivity Pack that includes a Windows program and serial cable to move data between the OmniGo and your PC.

The 3.8- by 6- by 1-inch OmniGo weighs just over 11 ounces and runs on a pair of AA batteries; there's a lithium disk battery for data backup. To save power, the display shuts down after about a minute of inactivity, but you get back to the same screen when you turn the OmniGo on again.

The unit is too big to fit comfortably in a shirt pocket. It is, however, small and light enough to ride in a coat pocket. It is ruggedly built and has an appealing curved design.

The square 240- by 240-pixel monochrome LCD measures 3.5 inches diagonally, which is smaller than the LCDs of many other organizers and PDAs. The OmniGo has a touch-sensitive screen and comes with a small stylus, which can be unobtrusively stowed in a retractable area and used as a pointing device or to draw on the screen.

The OmniGo also supports the Graffiti handwriting system, which is a shorthand style of writing that makes for accurate handwriting recognition. That is, once you get the hang of it. With a little

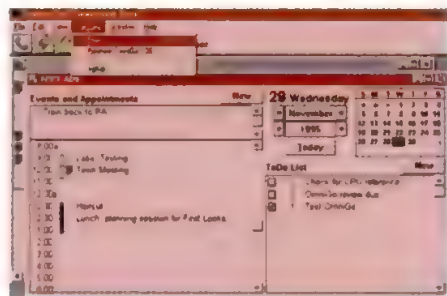
practice, you can enter information fairly quickly with the stylus.

You can enter data either with the pen or the Chiclet-style keyboard. The keys are very small, so most people are not going to be able to type quickly, but the small size is manageable for short entries such as telephone numbers or addresses.

For pen-only use, the top half of the case folds over itself, making a compact writing pad. A feature lets you rotate the screen's orientation from landscape to portrait mode to make it feel more like a real pad and pencil.

There are strips of application icons along each side of the screen. In addition to choices that include an Appointment Book, Notepad, and Phonebook, you also get a calculator, a set of financial utilities (including the equivalent of an HP 12C financial calculator), a spreadsheet program, and a database program. There is also a Jotter program that lets you create short notes that can then be attached to objects created by the other applications or incorporated into a Notepad file.

The OmniGo's Appointment



LIVE DATA: The optional Connectivity Pack lets you update your data files on your computer as well as on your OmniGo.

Book is one of the strongest applications in the group. You can maintain a list of appointments and events and also keep a To Do list. The display includes daily, weekly, monthly, and quarterly

formats, making it a versatile reference calendar. And you can attach detailed notes to any item, including hand-drawn graphics (such as directions to a meeting site).

The OmniGo has a serial port and a Type II PC Card slot. It comes with 1MB of RAM and 3MB of ROM, but you can increase the data-storage capacity using the PC Card slot. The software supports a number of popular printers, including HP LaserJets and DeskJets. You can get



third-party cables that will connect the OmniGo's serial port to a printer's parallel port.

The standard features are fairly easy to use, but the system is really incomplete, because the Connectivity Pack that automatically synchronizes files between the OmniGo and your PC only works with the Appointment Book, Notepad, and Phonebook.

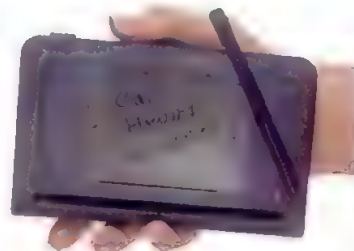
The Connectivity program can also import and export data in several formats, including dBASE, comma-delimited, and tab-delimited files.

Another significant limitation is the fact that the small screen has no backlight, making it difficult-to-impossible to read under low-light conditions, such as those in a restaurant

or movie theater. Of greater concern is that at times the OmniGo does not perform as sprightly as other PDAs. For example, it takes as long as 5 seconds to start any of the applications. Once an

app has started, the system performs well, and a small coffee-cup icon in the center of the screen shows that the OmniGo is moving from one task to another.

The real power of the device appears to lie not in its standard applications but in add-ons. There are a number of third-party programs and development tools that could make the OmniGo indispensable for specific applications. All users will be eligible to receive a free copy of Intuit's Pocket Quicken, which



HANDFUL OF DATA: Whether keyboard-based or pen-centric, the HP OmniGo 100 is a flexible notetaker.

can be used with Pocket Quicken Connect (\$29.95) to link OmniGo-resident Quicken files to those on your PC. There are also programs available for wireless communications, downloading stock quotes via pager card, and a data-transfer program that lets you transfer data from any OmniGo application to your PC.

You can also build your own hypertext reference documents using Bindery from Geoworks, or create your own custom programs using the IZL programming language from Feras Information Technologies.

If you need portable data, it may still be a toss-up between paper and a PDA. If you need a smart organizer that can exchange updates with your desktop-based information files, then the OmniGo 100 can put data where it's needed.

HP OmniGo 100. Estimated street price: With 1MB RAM, 3MB ROM, 3.5-inch monochrome screen, \$349. **Connectivity Pack.** List price: \$119.95. Hewlett-Packard Co., Corvallis, OR; 800-443-1254. Circle 417 on reader service card.

Quarterdeck CleanSweep™ 95 is the first 32-bit uninstaller for all versions of Windows. We also believe it's the only uninstaller worth looking at, period. But you don't have to take our word for it.

"When you delete files, CleanSweep bundles them into a package, compresses them, and archives them where it can find them again... this looks to be... one of the 'must have' Windows '95 supplementary programs."

JERRY POURNELLE, BYTE, NOV 95

"CleanSweep 95's user interface is still the simplest and most intuitive of all the commercial uninstallers PC Week Labs has seen... CleanSweep's system cleanup features were very strong, helping us find duplicated, unused, and orphaned files to remove from our systems."

JIM RAPOZA, PC WEEK, NOV 95

"To the rescue comes Quarterdeck's new CleanSweep. When I installed CleanSweep, I had a spindly 5MB left on my 340MB hard disk's C: partition. As I write this I have 33MB. CleanSweep 95... is the janitor who can get you back that accidentally tossed manila folder the next day. It gives you a new lease on disk space with a vow never to let you junk your drive up again."

PAUL ANDREWS, SEATTLE TIMES, OCT 95



PRINTERS

Epson Stylus Pro XL: One Step Closer to the Digital Darkroom

By Daniel Grotta and Sally Wiener Grotta

At \$2,125, the Epson Stylus Pro XL is by far the least expensive color printer capable of producing tabloid output (11 by 17 inches). Epson is targeting the Pro XL at desktop publishers, photographers, designers, and others who need large color output for proofs but don't have the budget to buy a \$4,000-to-\$18,000 thermal wax transfer or thermal dye transfer printer.

The Pro XL is a 22-pound,

an ink cartridge until it's empty, using the printer's built-in head-cleaning system frequently, using only Epson's paper and transparency sheets, and running the cleaning sheet that comes with each pack of Epson paper through the printer.

Setting up the printer is simple. It can be installed as a Windows 95 Plug and Play device if you have a bidirectional parallel port and cable. The printer can display on your computer such feedback as elapsed printing time, error

cludes Document Types, Half-toning, Image Settings, Paper, and Print Mode/Options. Output quality suffers if you set any parameter incorrectly. For instance, if you erroneously select Photograph for an illustration, you'll get terrible-looking scan lines every quarter of an inch.

It's equally important to specify whether you're printing onto plain paper, coated paper, or glossy paper. We printed on a variety of media: plain paper, generic ink jet paper, Kodak ink jet paper, and several grades of Epson's own paper (the company makes 17 different varieties). In every instance, the Epson paper produced brighter, more colorful, sharper, smear-free output. Although Epson's glossy paper is

\$3,995 Fargo Pictura 310 or the \$14,995 Tektronix Phaser 480X, both of which are tabloid-size thermal dye transfer printers (though the Pro XL costs significantly more than its smaller brother, the \$800 letter-size Stylus Pro, which is identical except for the Pro XL's 5-inch-wider carriage). But the cost of consumables for the Pro XL can outstrip that of thermal dye transfer printers. The Pro XL requires a \$17.50 black and \$35 combination cyan, magenta, and yellow cartridge, which has a rated yield of 670 letter-size color sheets at 360 dpi and 5 percent coverage.

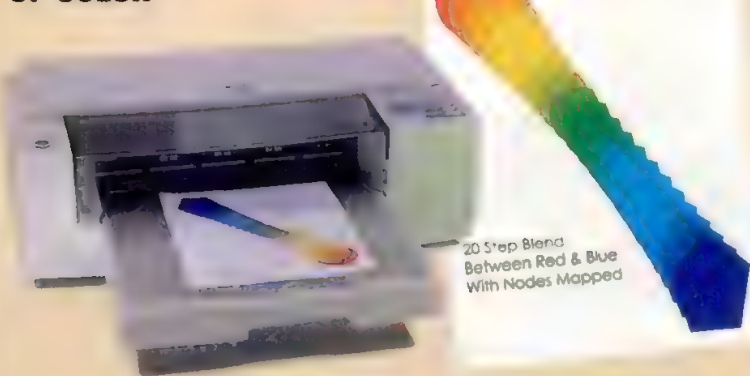
These cartridges, when used with Epson's high-resolution, photo-realistic glossy 13- by 19-inch paper (100 percent coverage at 720 dpi) will yield only eight to ten sheets. Since each sheet of 13- by 19-inch glossy paper costs \$6.07, that translates to about \$10.77 per print. Of course, only photo-realistic output needs 100 percent coverage; text, charts, and illustrations typically require only 5 to 15 percent.

RANGE OF RESULTS

The Pro XL's output ranged from gorgeous (for illustrations) to so-so (for near-photographic output) to average (for TrueType fonts). Although there were minor trapping problems (gaps where colors meet), we were impressed with the lack of dropouts and artifacts. The trade-off for good-looking, large prints is time: The Pro XL took 57 minutes 14 seconds to print a 39MB TIFF file at 720 dpi on 13- by 19-inch glossy paper. Even printing a page of single-spaced text on coated paper at 720 dpi took 6 minutes 18 seconds.

But if you can live with slow output and pricey consumables, the Stylus Pro XL is an excellent and affordable large color printer. **Epson Stylus Pro XL.** List price: \$2,125; Adobe PostScript option, \$310. Requires: 8MB RAM, 10MB hard disk space, Microsoft Windows 3.1 or later. Epson America Inc., Torrance, CA; 800-289-3776. Circle 426 on reader service card.

THE LONG AND SHORT OF COLOR



PRO ILLUSTRATOR: The Pro XL excelled at illustrations, such as this 720-dpi color-blend diagram on Epson paper. The unit's photo-quality prints were somewhat less impressive, however.

wide-carriage ink jet printer capable of producing virtually full-bleed, 720- by 720-dot-per-inch (dpi) CMYK output on 13- by 19-inch paper. Unlike most other ink jet printers that incorporate disposable thermal print-heads in their ink cartridges, the Pro XL features a permanent nonthermal, piezoelectric (pressurized) printhead that supposedly yields better colors and sharper images. As it is nondisposable, the printhead is more susceptible to damage and image degradation over time.

To counter this, Epson strongly recommends never removing

messages, and so on. Snapping in the ink cartridges should be easy, but the head moves into the proper position for only 60 seconds. If you haven't properly inserted both cartridges in that time, the head zips to the right, which can damage the flaps that snap over the cartridges.

HARD STARTS

On our tests, we found that the Pro XL is not a set-and-forget device but a somewhat finicky, unforgiving printer that requires extra attention to produce optimum quality. Epson's driver features a tabbed dialog box that in-

cludes Document Types, Half-toning, Image Settings, Paper, and Print Mode/Options. Output quality suffers if you set any parameter incorrectly. For instance, if you erroneously select Photograph for an illustration, you'll get terrible-looking scan lines every quarter of an inch.

Adobe PostScript driver comes with Pantone color management software that helped, however. The Pro XL's photographic output was marred by the driver's preference for printing full-bleed images. Rather than adjust the image's dimensions according to the file size, our 18MB, 36MB, and 40MB files all printed to fit the paper. And because the amount of information varied considerably, there were considerable gaps between the dots. We were unable to tweak the images to tighten up the pixels.

At \$2,125, the Pro XL is inexpensive compared with the



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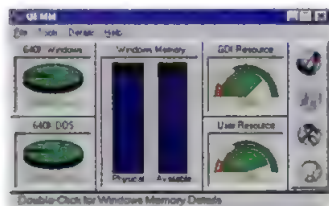
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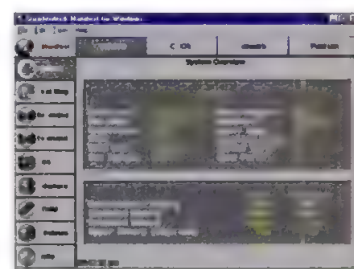


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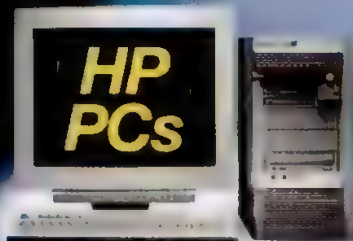


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PIMs

Schedule It! Keeps Meetings Straight but Runs Out of Steam

By David Haskin

Outlook Software Corp.'s \$79.95 Schedule It! is a simple-to-use program with the power to control the comings and goings of small, appointment-driven workplaces such as doctor's offices. But it doesn't have enough power to work with larger groups.

Schedule It!'s intuitive interface simplifies basic tasks. To record an appointment or task, you drag an icon from the toolbar to the calendar. This displays a dialog box in which you select attendees, resources (such as meeting rooms), and other details such as start and end times.

Another dialog box notifies you of meeting conflicts, and at the click of a button, Schedule It! finds the next time at which each attendee is available. Schedule It! can then issue a meeting notice to attendees via MAPI- or VIM-compliant e-mail systems.

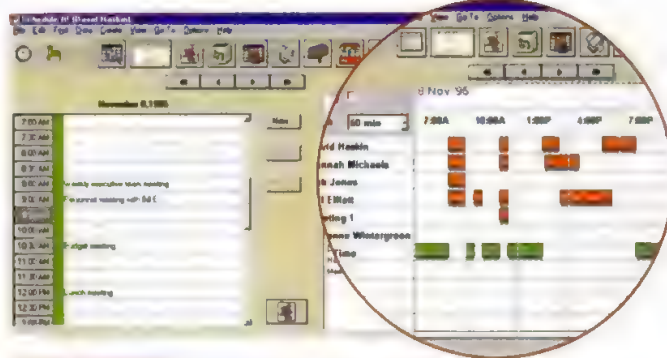
Any networked user can schedule a meeting, but only the initiator can edit the meeting's details. Schedule It! has a Gantt-like view showing the availability of all selected individuals, but this chart only has a daily mode, not weekly or monthly modes. These long-term views would be useful when scheduling employee work shifts.

Though Schedule It!'s basic features are a breeze, many advanced capabilities are either missing or confusing. For example, it can't use names from NetWare's Bindery. And while you can import comma-delimited database files, the process is clumsy; it's easiest to create Schedule It!'s address book from scratch.

Schedule It! can print in the formats of several popular planners such as Day Runner, but it can't print in Day-Timer format. It can print basic reports showing schedules, but it has few customization options and no print-preview mode.

A vertical color-coded bar next to the calendar shows available times in green and unavailable times in red. What's confusing, though, is that the bar always appears green unless you click on a specific appointment. The bar then displays the time taken by that appointment in red but doesn't show time taken by other appointments or scheduling conflicts. This makes it impossible to check for available time at a glance.

Schedule It! will be inadequate for large workgroups, but its



GROUP SCHEDULING: Schedule It!'s color-coded, user-friendly interface lets you see everybody's daily schedule at a glance (inset).

combination of simplicity and basic scheduling abilities makes it a good choice for smaller offices. **Schedule It!.** List price: \$79.95. Requires: 4MB RAM (8MB recommended), 8MB hard disk

space, Microsoft Windows 3.1 or later, Windows 95. Outlook Software Corp., Dallas, TX; 800-925-5700, 214-713-6370; fax, 214-713-6308. Circle 415 on reader service card.

PROJECT MANAGEMENT

Project KickStart: Brainstorming with Your PC

By Craig Stinson

Project KickStart for Windows, from Experience In Software Inc., occupies a niche best described as "inspirational software." The \$99.95 KickStart provides a seven-step program for brainstorming a project as well as a way to import your work to popular project management programs.

KickStart's seven steps involve naming the project, defining its broad phases, listing goals, thinking about similar projects that might provide useful data, listing the people who will contribute to the project's design or execution, anticipating obstacles, and assigning tasks to people. Several of these tasks include substeps. The traditional project management process of defining tasks, for example, appears in several places, as substeps to Phases, Goals, People, and Obstacles.

Working with KickStart is a

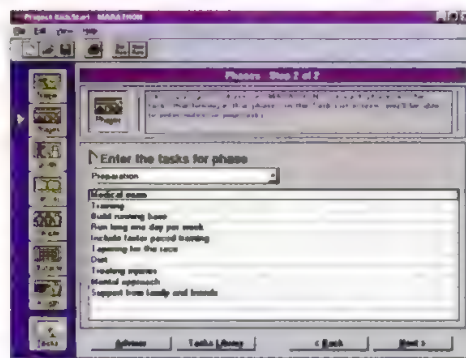
matter of reading the advice and filling out forms. The current version (a refurbishment of a DOS product) provides an attractive button bar to walk you through the steps and substeps. Drag-and-drop simplifies list selections, such as the assignment of people to tasks or phases. A library command lets you store

Additional reports let you peruse the tasks and assignments without the notes or study the breakdown of Phases, Goals, People, and Obstacles.

Along the way, you can read pithy encouragements from the manual ("If you fail to plan, you plan to fail"), and when you've completed the process, KickStart can export your work to a true project management program. KickStart effects this transfer seamlessly with Microsoft Project, for example.

If you're going to use a project management program, Project KickStart will help you get your task list and resource assignments in order, but it won't do any heavy labor for you. It may, however, prove valuable if you're intimidated by project management programs or if you simply want a checklist of items to consider when planning a project.

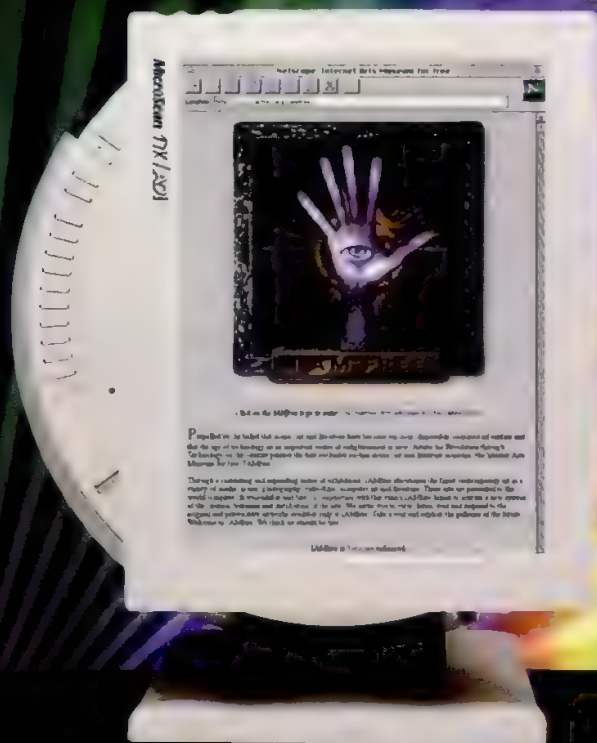
Project KickStart for Windows. List price: \$99.95. Requires: 4MB RAM, 1.6MB hard disk space, Microsoft Windows 3.1 or later, Windows 95, Windows NT. Experience In Software Inc., Berkeley, CA, 800-678-7008, 510 644-0694; fax, 510-644-3823. Circle 416 on reader service card.



BRAINSTORMER: KickStart helps you break down projects into phases with specific tasks.

and reuse Phases, Goals, Resources, and Obstacles in future projects.

A KickStart project may include up to 1,000 tasks and 100 people. You can attach notes to any task. Notes can be printed separately or in a columnar structure alongside tasks and assign-



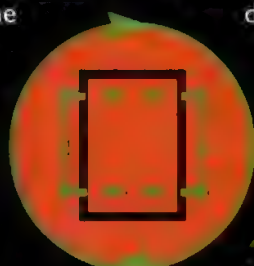
Surfing the Internet just took a turn for the better.

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The ADI MicroScan™ 17X monitor puts a whole new spin on the way you work. In seconds, it can switch from landscape to portrait without closing any running applications. Just click on the portrait driver icon, turn the monitor, and hit the degauss button on the front-panel. It's that easy to flip between Internet home pages, word processors, oversized spreadsheets, and other applications—and still get the big picture.

Larger Viewing Area In Its Class

The MicroScan 17X is like getting a 21" display for the price of a 17" monitor. Its vertical viewing area in portrait mode is larger than any 17" or even 21" monitor on the market, and easily accommodates an entire 8.5" x 11", legal or A4 page in portrait view. No need to scroll or print to see the whole page. This means you'll be able to do twice as much in half the time.



High-Quality Feature Set

The MicroScan 17X also has many other things to flip over. Like a 17" CRT display with a 16" diagonal viewing area, 1024 x 768 resolution, flicker-free 76Hz performance, .28mm dot pitch, microprocessor digital controls, even Plug-n-Play compatibility. It's a feature set you won't find in competitively priced monitors. And since ADI builds monitors for leading PC companies worldwide, you know you're making a quality investment for the long haul. The MicroScan 17X is also backed by a three-year warranty. Best of all, you don't have to be a Web Master to get one. Just call 1-800-228-0530 for your nearest dealer.

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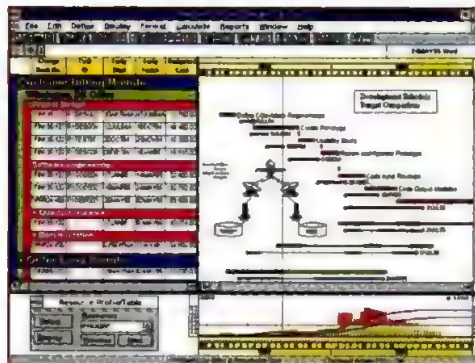
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UTILITIES

Three OS/2 Utilities Packages Bring Warp to Warp Speed

By Edward Mendelson

While most of the excitement about 32-bit operating systems of late has been over the release of Windows 95 and its vast wave of supporting utilities, IBM's OS/2 continues to attract dedicated software developers. The three OS/2 utilities that we reviewed represent the genre's best efforts and in many ways pick up where IBM programmers left off.

OBJECT DESKTOP

Stardock Systems' \$99.95 Object Desktop gives OS/2 Warp the interface it deserves, eliminates many annoyances of the Warp desktop, and adds dozens of conveniences and enhancements.

In place of OS/2's drive and directory folders, the package offers a fast, intuitive Object Navigator. This includes a button that instantly creates a shadow of the selected file and lets you drag files and folders to a "fast path" list for instant access while viewing any drive or directory.

In addition to WorkPlace Shell integration, Object Desktop substitutes a sleek new editor in place of Warp's minimalist text editor when you open an object with no assigned application association.

Speed enhancements include a caching option that stores folder contents in memory so that you don't have to wait while OS/2 reads the disk.

Object Desktop makes OS/2 look and feel like a new version. **Object Desktop.** List price: \$99.95. Requires: 8MB RAM, 3MB hard disk space, OS/2 2.1 or later. Stardock Systems, Canton, MI; 313-453-0328; fax, 313-453-1480. *Circle 428 on reader service card.*

DESKMAN/2

DeskMan/2, the most elegant and usable of all OS/2 desktop-maintenance utilities, runs almost all its features from a single icon. This \$79.95 package from Development Technologies lets you preserve, modify, and restore anything from a single icon to everything on the desktop. The program also lets you store the whole desktop for reinstallation on another computer.

To start up the program, you simply right-click on its icon and choose one of many options from the pop-up menu. The ones you'll probably use most are the options that save and restore the desktop and SYSTEM.INI files. The program's icon changes appearance

to indicate what will happen when you drop another object onto it.

A double-click on the DeskMan/2 icon opens a window that lists all the desktop objects that it has saved. You can restore one or more objects or create a REXX command file that will generate the object. If you move programs from one drive to another, DeskMan/2 lets you change the drive letters in the objects with a single command.

The package optionally installs extensions to WorkPlace Shell pop-up menus. The extensions let you close a chain of cascading windows with one keystroke, move the current window behind the one below it, and add a Windows 95-style menu to drag-and-drop operations.

A \$99.95 Productivity Pack version of DeskMan/2 includes partial versions of DCF/2, the Graham Utilities, and a PIM and CPU monitor. All told, DeskMan/2 is a marvel of elegance and efficiency. **DeskMan/2.** List price: \$79.95. Requires: 4MB RAM, 3MB hard disk space, OS/2 2.1 or later. Development Technologies Inc., Columbia, SC; 803-790-9230; fax, 803-738-0218. *Circle 429 on reader service card.*

UNIMAIN

IBM programmers never bothered to create an interface that would let users modify, clean, and repair the .INI files that govern the internal workings of OS/2 Warp.

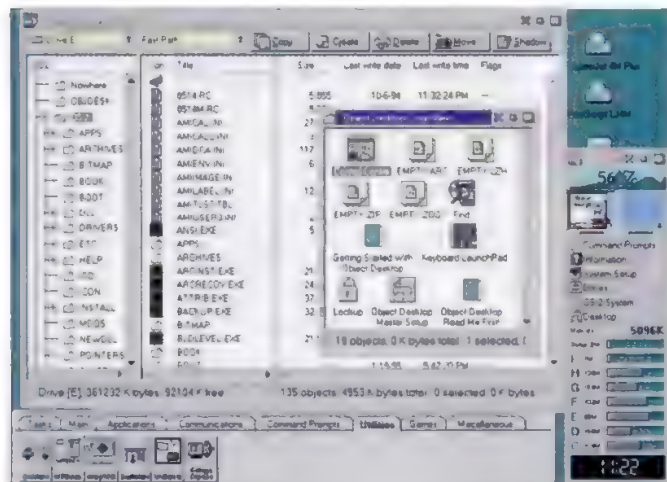
SofTouch Systems' \$99.95 UniMaint does the job by removing data from Warp's setup files and uninstalling OS/2 applications.

The program backs up multiple generations of the desktop and lets you copy part or all of the desktop to another computer. It displays the contents of the binary OS2.INI and OS2SYS.INI files in an editable, more readable form, and it intelligently deletes defective or unlinked entries that remain in these files whenever an application is removed.

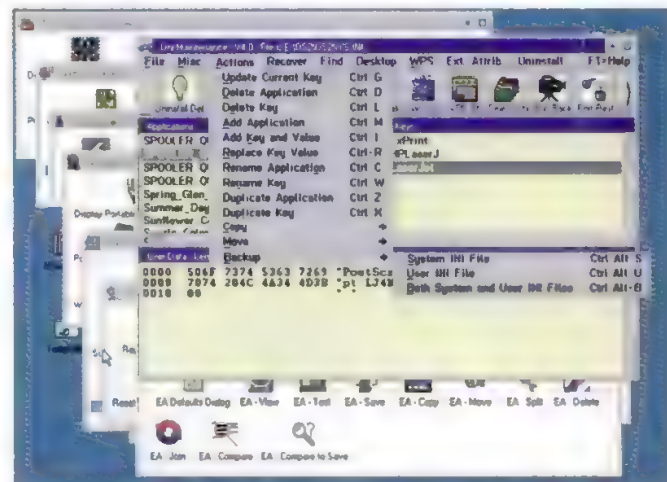
When you drag the icon of the program you want to remove to UniMaint's uninstall window, a series of dialog boxes then displays objects and settings that the program recommends for removal; you can accept or modify these suggestions. UniMaint isn't as sophisticated as Windows uninstallers, however, and sometimes offers to remove files that will render the other programs unusable.

The package isn't as elegant as DeskMan/2, but it digs deeper below OS/2's surface. UniMaint offers more than enough power over OS/2's internals to make up for the minor annoyances of its interface.

UniMaint. List price: \$99.95. Requires: 2MB RAM, 2MB hard disk space, OS/2 2.1 or later. SofTouch Systems Inc., Oklahoma City, OK; 800-944-3028, 405-947-8085; fax, 405-632-6537. *Circle 430 on reader service card.*



MAKEOVER: Object Desktop replaces OS/2's folder windows and launchpad and improves the look and performance of the entire desktop.



TOTAL CONTROL: UniMaint's menus control just about every OS/2 setting, from backing up system files to uninstalling programs.

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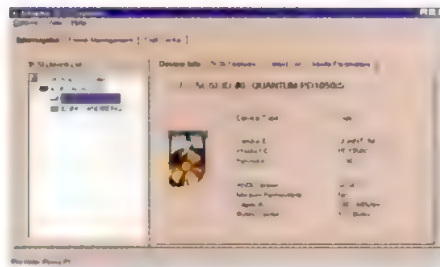
SCSI

EZ-SCSI 4.0: The Easy Route to SCSI

By Winn L. Rosch

Seeking to tame today's most feared hardware interface, EZ-SCSI 4.0 from Adaptec not only helps you get your SCSI devices up and running but also adds utilities to make them more useful. The \$89 package installs drivers, teaches you the rudiments of SCSI, and commands devices as diverse as tape drives, scanners, and CD-ROM drives.

Like previous versions, EZ-SCSI 4.0 is easy to configure. It takes only a few minutes of working through the program's menus to install the drivers you need to get your SCSI devices operating properly. EZ-SCSI 4.0 works well with DOS, Windows 3.1, Windows 95, and Windows NT. A floppy disk is included to avoid the Catch-



IDENTIFY: EZ-SCSI can identify and configure most SCSI devices.

22 of needing a CD-ROM drive to install the same drive.

EZ-SCSI 4.0 doesn't stop working once your devices are installed. With the program, you can explore the resources used by your SCSI devices, check performance, and even conserve energy with a power management utility.

To get more from your SCSI devices, EZ-SCSI 4.0 includes several utilities for CDs with an emphasis on ease of use rather than extensive options. The program's audio CD Player gives you four interfaces to play audio CDs: standard player, jukebox, mini-window, and micro-window. Its Photo-CD software, Magic Lantern, lets you view and copy images stored on-disk in Kodak's format.

There are two utilities for CD-ROM recorders: one that builds and writes CDs and a copy utility that quickly duplicates disks from CD player to CD recorder.

A backup program integrates a Windows 95 interface with the ability to handle any SCSI device. A simplified quick-scan system lets you turn your Twain-compliant scanner and printer into a rudimentary photocopier. All of EZ-SCSI 4.0's functions performed their appointed tasks well, though the CD copier crashed during a futile search for a nonexistent drive.

Although power users may find EZ-SCSI 4.0 superfluous, it will delight PC neophytes, who should feel that they're in complete control.

EZ-SCSI 4.0. List price: \$89; upgrade, \$49. Requires: 4MB RAM, 10MB hard disk space, Microsoft Windows 3.1 or later, Windows 95, Windows NT, ASPI-compatible SCSI host adapter. Adaptec Inc., Milpitas, CA; 800-442-7274, 408-957-7274; <http://www.adaptec.com>. Circle 431 on reader service card.

UTILITIES

QEMM 8.0 Helps PCs with More than 4MB of RAM

By Barry Simon

A variety of memory management techniques for optimizing systems using DOS, Windows 3.1, and Windows 95 are offered by Quarterdeck Corp.'s \$70 QEMM 8.0. Along with the program's traditional staple of memory utilities, this version includes MagnaRAM2. All the parts fit together well into a single Windows interface, but using them on a system with 4MB of RAM will likely slow performance.

Longtime QEMM users will feel right at home with Version 8.0, because the program includes many familiar utilities, such as FreeMeg (a Windows conventional memory manager), Manifest (a diagnostic tool and memory reporter), Optimize (a one-click way to boost available memory), and QuickBoot (a boot-up shortcut that eliminates the power-on self-test). In addition, QEMM now sports a Windows control panel that monitors

system memory in real time.

But the big news is the inclusion of MagnaRAM2, a program that performs Windows RAM compression and virtual RAM swapping, which works under Windows

data to disk, MagnaRAM2 intercepts the information, compresses the swap data, and places it in this RAM buffer. When the buffer is full, the data is swapped to disk.

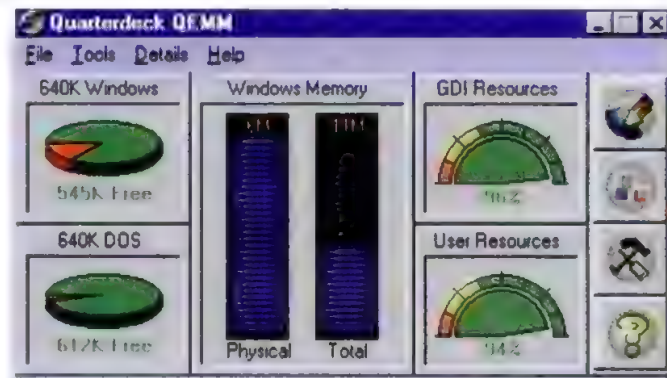
Because of MagnaRAM2's buffer, programs actually have less available RAM—meaning that performance can suffer. On a 486 PC with 6MB of RAM, it took 4 minutes to load the Microsoft Exchange Inbox with MagnaRAM2

work with large files and have systems configured with at least 8MB of memory.

QEMM takes memory management to a new level. For example, we used Setup to get the Resume function on a Toshiba T4400 notebook running under Windows 95. Rather than playing with the system's parameters and rebooting, we changed QEMM's Enabling Resume setting from Auto to Yes. We then ran QEMM's Optimize program, and Resume was up and running.

While a memory manager was a must for serious DOS and Windows 3.1 users, fewer users will need one with Windows 95. But those with real-mode drivers, applications that require large DOS sessions, or PCs with 8MB of RAM or more and large files to load will welcome QEMM 8.0 as a step forward.

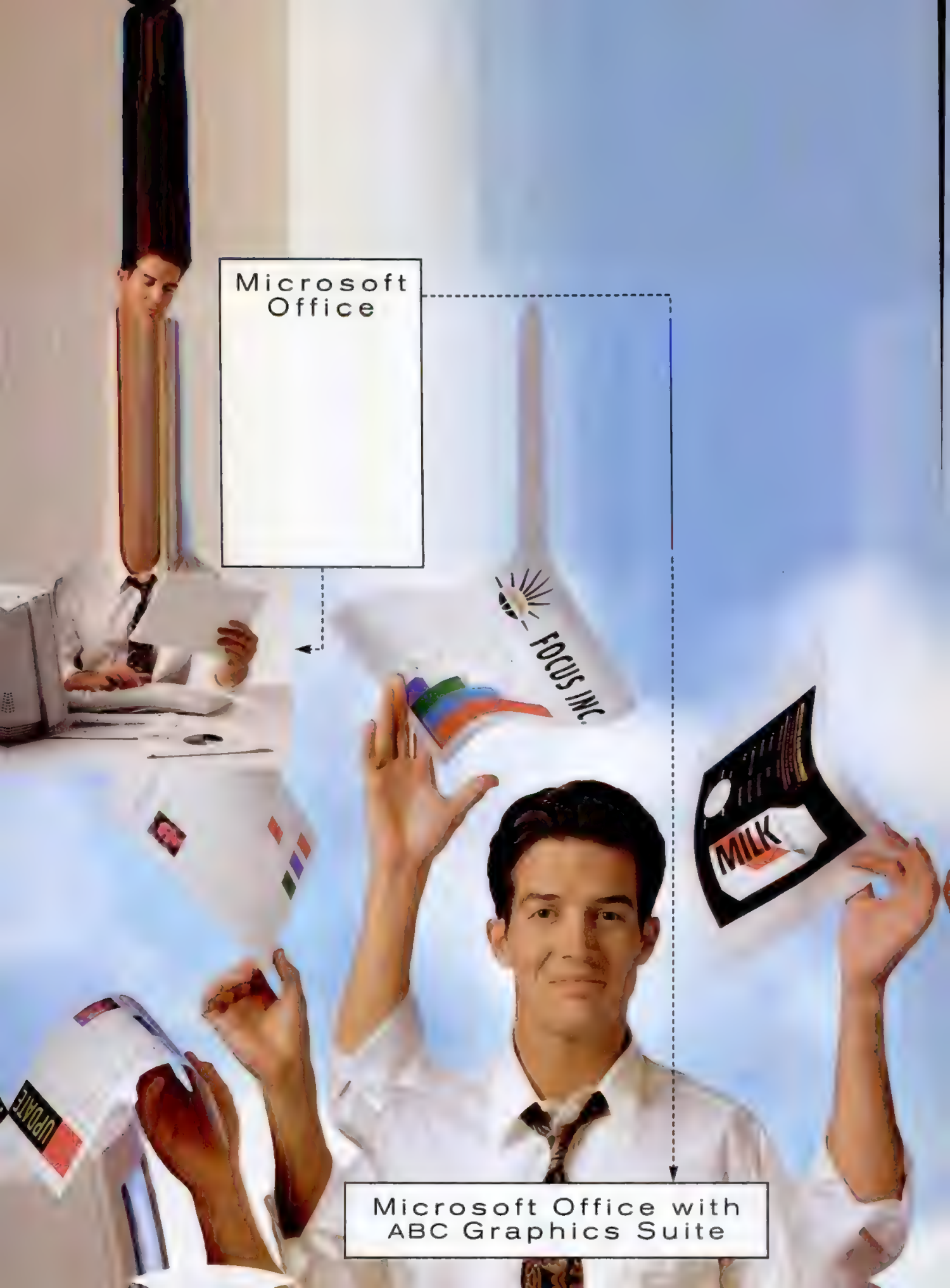
QEMM 8.0. Estimated street price: \$70. Requires: 4MB RAM, 5MB hard disk space, Microsoft Windows 3.1 or later, Windows 95, Windows NT, DOS. Quarterdeck Corp., Marina del Rey, CA; 800-683-6696, 310-309-3700; <http://www.quarterdeck.com>. Circle 432 on reader service card.



QUICK CLICK: QEMM's integrated Windows control panel displays critical memory information and gives you one-click access to Manifest, Optimize, and Setup.

3.1 or Windows 95. By default, MagnaRAM2 allocates one-quarter of the system's memory as a buffer. When Windows first swaps

disabled and 16 minutes with MagnaRAM2 enabled. We found that the program's RAM compression was useful to those who



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In fact, during recent "Cross Country"™ tests² by VeriTest, inc., a

test lab, the Dell Latitude XPI P75 dual scan notebook lasted an average of four hours and forty minutes. Of course, actual battery life will vary depending on the nature and use of your configuration. For example, our XPI P120 dual scan clocked in on the same tests at four hours and twenty-one minutes. So you get longer battery life with a Dell Latitude notebook. Available in 75,

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K-1111 401100

Second Looks

LIVING WITH THE PRODUCTS WE REVIEW

By Brian Nadel

NOTEBOOKS

Avoiding ThinkPad Brownouts

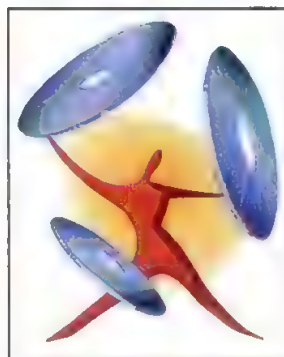
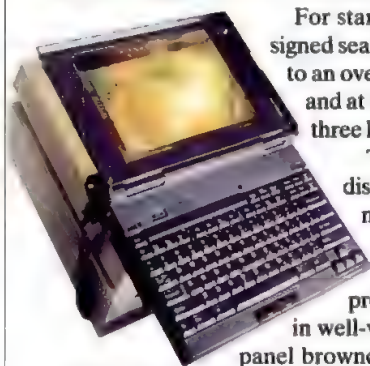
THE IBM THINKPAD 755 CV IS AN INGENIOUS PORTABLE PC with a split personality (First Looks, July 1995): It's a full-powered notebook PC with a 10.4-inch, active-matrix color display that converts to an overhead projector panel. Since you don't have to pack a separate overhead projector LCD, the ThinkPad 755 CV can be a great space saver if you frequently give group presentations. But we found that the ThinkPad 755 CV's double life compromises quality.

For starters, you have to use a poorly designed seat belt to attach the \$7,000 notebook to an overhead projector. It's hard to set up, and at times it seems as if you need at least three hands to balance the system.

The panel's sensitivity to heat is more disconcerting. The system's active-matrix display can turn brown if it overheats. This limits the system to use with overhead projectors that produce less than 6,000 lumens—even in well-ventilated areas. To prevent LCD-panel brownouts, IBM now includes a snap-on

cooling fan with the Pentium-equipped CV models. Rather than using a pair of fans, as Boxlight does on its C300 notebook (First Looks, January 22, 1996), the ThinkPad has a single fan, which draws its current from the system's power adapter. The fan sits between the LCD panel and the overhead projector, blowing air across the panel's surface.

The add-on fan, \$89 through an IBM dealer, is easy to connect and is a small price to pay to protect this expensive piece of equipment. The next step for IBM's engineers is to figure out a way to attach the screen to the overhead projector without requiring an octopus to set it up.



Three Disks, No Waiting

WHEN WE REVIEWED THE Gateway 2000 P5-120 Pentium PC (First Looks, April 25, 1995), the inclusion of the Torisan CDR-C3G three-disk CD-ROM changer was like a breath of fresh air. The unit, which fits into a standard PC bay, can shuffle a trio of CDs in a few seconds.

As we became more experienced with the system, we found that the disk changer worked like a charm on Win-

dows 3.1 systems but was not as friendly to PCs running Windows 95 or Windows NT. On some systems, the disk changer recognized only the first of the three CDs, eliminating any advantage over a cheaper, single-disk CD-ROM drive. On others, the drive would randomly shuffle through the disks for no apparent reason, failing to stop at the chosen disk.

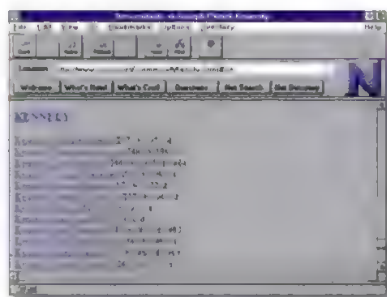
The reason for these problems is that the drivers that shipped with early units fully supported only Windows 3.1. After all, a large number of users bought the Gateway PC with this drive several months before Windows 95 shipped, and well before NT reached its current popularity as a workstation platform.

The quick fix is to download the TORISAN3.EXE file from Gateway's CompuServe forum and load it on your PC. It contains the most recent drivers, and should allow Windows 95 and Windows NT users to enjoy the convenience of their multidisk CD changer.

WINDOWS SOFTWARE

Growing Your Family Tree

COMMSoft's ROOTS IV family tree software was an easy program for setting up a family tree, but had two major shortcomings: The program did not have a spell-checker, making it hard to maintain the correct spelling of names, and the only graphics format the program would accept was Win-



dows bitmapped files, which made filling out the tree with photos and artwork awkward.

CommSoft has fixed both short-

comings with a maintenance release. Roots IV now comes with a 140,000-word dictionary, which includes 10,000 proper names. The program is still limited to .BMP imports, but CommSoft offers a graphics conversion utility so you can use a greater variety of file formats. The graphics conversion utility is available from CommSoft's bulletin board at 707-838-6373; CommSoft's phone number is 800-327-6687.

CommSoft programmers also took the opportunity to extend the program's power by adding report-printing flexibility and the ability to create a family-tree home page on the World-Wide Web. For examples and information, check out CommSoft's Web site at <http://www.sonic.net/~commsoft/family.html>.

The Roots IV update is free if you bought the program after September 1, 1995. It costs \$29.95 if you purchased Roots IV prior to that date.

LOOKING AHEAD

Tell me what you love and hate about these products and we'll share the information in future issues.
Apple PowerBook 5300 • Color ink jet printers • Digital

cameras • Flowcharting programs • IBM ThinkPad 760 CD • LANtastic for OS/2 • Multifunction peripherals • Quad-speed CD-ROM drives • SoftWindows • Windows 95

Utilities • ZDS Z-NoteFlex • Contact Nadel directly via MCI Mail (556-1500), via CompuServe (72241,1616), or on the Internet at BNadel@zd.com.

Okay. So you hold on to things. But who do they come to for a copy of last month's report? Exactly. Perhaps you'd be interested in the LTE 5000 — a new Pentium* powered notebook featuring interchangeable devices — so you can, among other things, add enough storage to dwarf an airplane hangar. Its front-loading MultiBay makes it completely modular, so you can mix and match capabilities as you see fit. Choose from a second hard drive, a CD-ROM drive, a second battery, or a floppy drive to create the notebook that's right for the task at hand. An expansion base also features two additional MultiBays, in case 2.7 GB isn't enough. Interested? Call us at 1-800-345-1518 (select PaqFax) or visit our Web site at www.compaq.com.*

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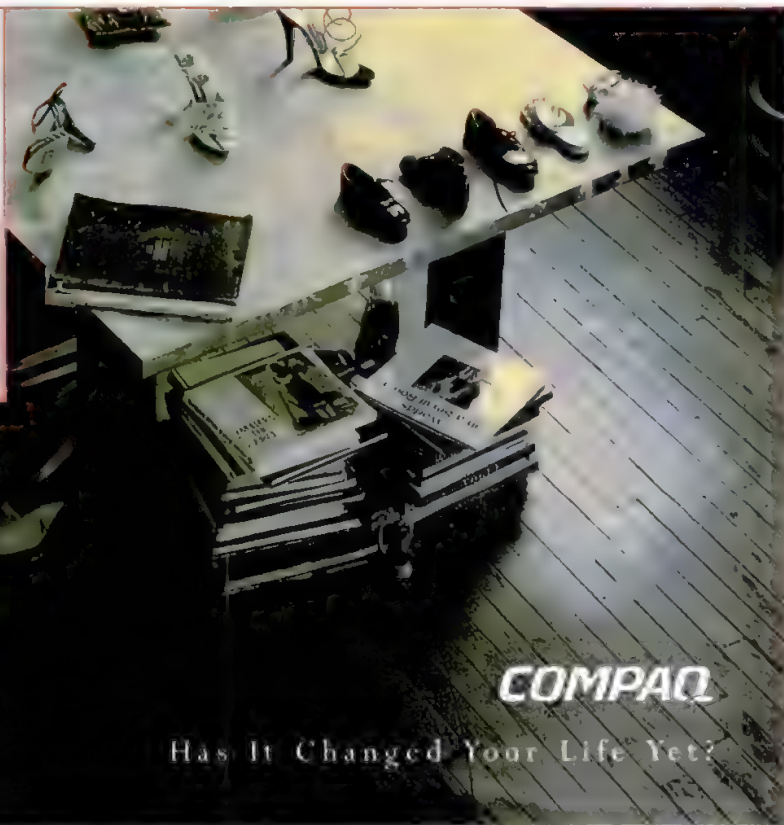
wardrobe

hotshot

TEBOOK FOR WHOEVER YOU HAPPEN TO BE.

You still have the invitation to
your 7th birthday party. (And you
know where it is.)

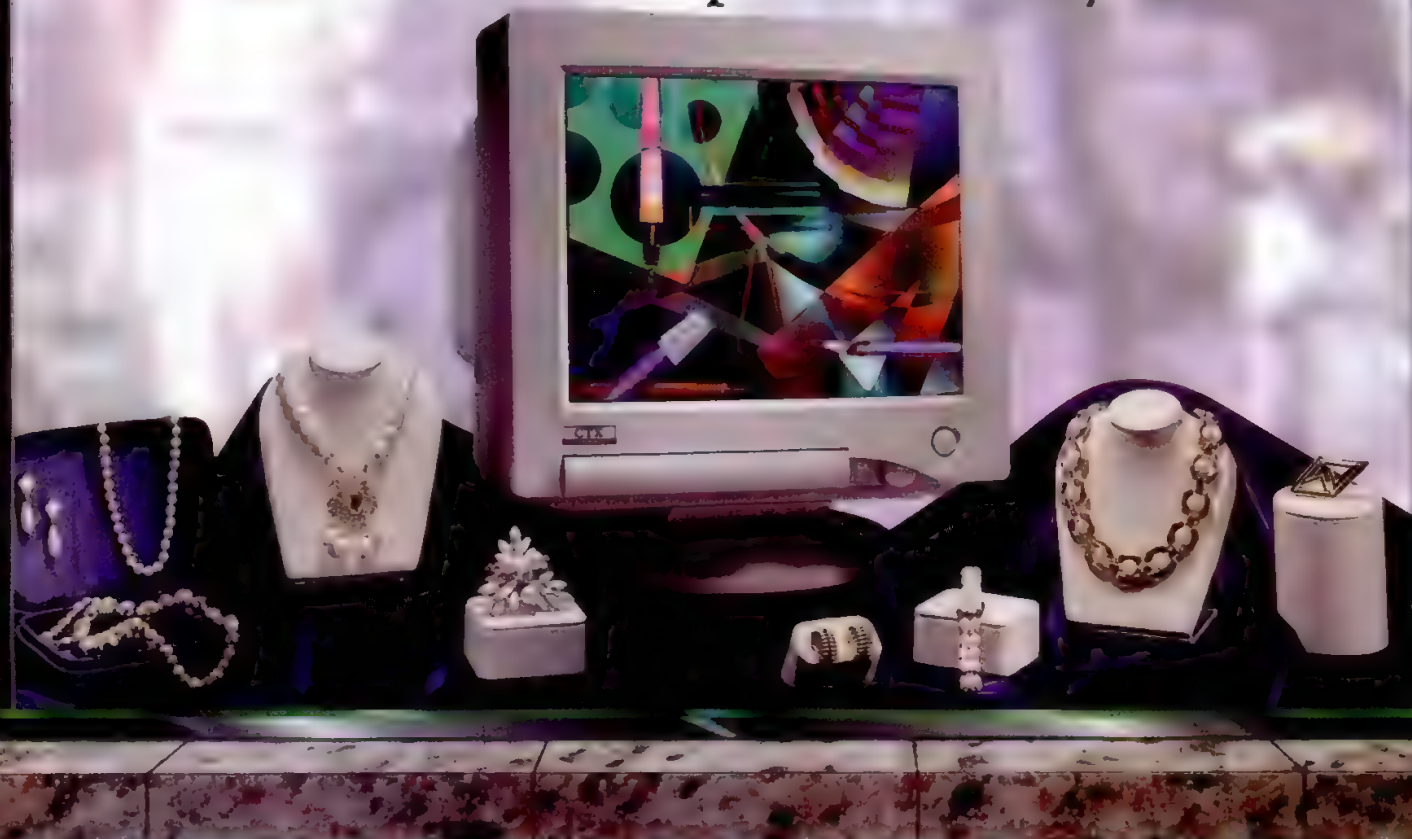
The thought of a second 1.35-
GB hard drive isn't astounding —
it's necessary.



COMPAQ

Has It Changed Your Life Yet?

You know the ultra-sharp 17" monitor you drooled over because it was virtually distortion free, displayed a couple of million colors but was too expensive to buy.



We made it affordable.



Finally, DiamondTron™, the world's most technologically advanced tube, is now available in a 17" (16.0" viewable area), and we've made it affordable. It's the CTX 17XA color monitor!

YOU GET a DiamondTron cylindrical, vertically flat, square-cornered display with an aperture grille mask design, along with a unique electron gun that delivers resolutions up to 1600 x 1200. And, an ultra-fine 0.25mm aperture grille pitch for PC, Mac, SUN and SPARC systems.

YOU GET incredible precision and clarity from center to corner, edge-to-edge, for dazzling colors and distortion-free images.

YOU GET unique features, like our On-Screen-Display (OSD) for convenient on-screen programming. And the SuperStar™ Power Management System (CPMS) that far exceeds Energy Star™ guidelines. The CTX 17XA also meets TCO standards, which lower energy and harmful electromagnetic emissions.

YOU GET a limited three-year warranty* on parts and labor. PLUS the monitor is Plug and Play™ compatible for Windows® 95.

YOU GET IT ALL... the CTX 17XA monitor... something to drool over.



17" Mac Monitor
August 1995



17" Mac Monitor
September 1995



17" Mac Monitor
March 1995



17" Mac Monitor
March 1995



National Sales: 800-289-8808 • Fax: 818-837-4341, Acct. No. 026
Eastern Region: 201-646-0707 • Southern Region: 404-729-8909 • Western Region: 909-598-8094

* Two year warranty on CRT. † Requires a DDC compatible video card. © 1995, CTX International, Inc.
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CIRCLE 286 ON READER SERVICE CARD

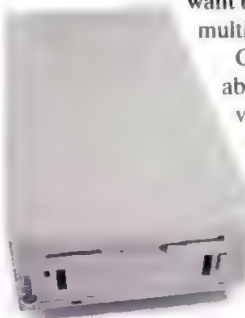
New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Melissa J. Perenson

Two Drives for the Price of One

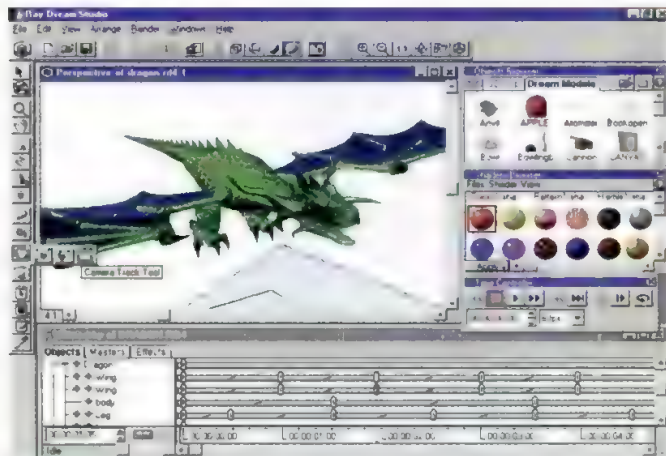
THE TIME HAS COME TO DELVE INTO TAPE BACKUP. But if you're like most of us, you're looking for a way to lessen the real-estate crunch on your system's available drive bays. Or perhaps you want to share large amounts of data easily among multiple systems.



PACKAGE DEAL: ComByte's Doubleplay drive.

ComByte's **Doubleplay** drive offers an affordable solution to both of these dilemmas by providing a drive that's a floppy disk drive and tape-backup device in one. Priced at \$249 for the external version and \$159 for the internal, standard 5.25-inch bay version, the Doubleplay uses QIC-80 tapes, which store up to 420MB using 2:1 data compression. The package includes everything you need to install the device. And the customizable software makes it easy to copy files to floppy disk or tape.

The floppy disk drive makes use of the powerful motor that propels the tape drive, so the drive performance is improved, attaining what ComByte cites as a drive spin time of 1 megabit per second, almost twice the speed of other floppy disk drives. **ComByte Inc.**, Fort Collins, CO; 800-990-2983, 970-229-0660; fax, 970-229-0652. *Circle 403 on reader service card.*



DREAM ON: Ray Dream Studio simplifies the 3-D graphics dream.

Pursuing the 3-D Dream

RAY DREAM IS PUSHING THE barrier of entry to three-dimensional graphics design with the release of its \$499 **Ray Dream Studio for Windows 95**, a package that

combines advanced features with ease of use.

The software integrates four 32-bit components—Dream Models, Extensions Portfolio, Ray Dream Animator, and Ray Dream Designer 4. New features include wizards to help you through the process of creating a 3-D image and time line editing of animation. **Ray Dream Inc.**, Mountain View, CA; 800-846-0111, 415-960-0768; fax, 415-960-1198. *Circle 401 on reader service card.*

Directory Assistance

PC411'S ON-LINE PHONE Directory—which includes phone, address, and ZIP code information for over 95 million homes—

lets you quickly search nationwide directory assistance by dialing in to the service's Los Angeles-based server. It costs \$24.95, with a \$15 usage credit, and has a flat charge of 50 cents per query for standard searches; most queries keep you connected for less than a minute. The **PC411 for Windows 1.1** software provides an organized, spreadsheet-like interface for sorting and storing information and accessing your retrieved queries. **PC411 Inc.**, Inglewood, CA; 800-243-8411; <http://www.pc411.com>. *Circle 404 on reader service card.*

PHOTOGRAPHY BY THOM O'CONNOR

HOT PROSPECT

Portable PC, SOHO Style

The **Canon Innova Book 350CD** is for those looking for all the features of a powerful multimedia notebook at a more affordable price. Based on Cyrix's 100-MHz 5x86 processor, the Innova Book packs an impressive assortment of features for a price of just \$2,600.

The Innova Book comes equipped with 8MB of RAM (expandable to 32MB) and a 540MB hard disk. The notebook has a 10.4-inch dual-scan color display; an active-matrix screen is not currently an option. The Innova Book comes multimedia-ready with a modular quad-speed CD-ROM drive, which can be swapped for an included 3.5-inch drive. Sound is taken care of by a 16-bit audio chip, and the video subsystem has 1MB of VRAM. The unit measures 11.5 by 8.9 by 1.9 inches, weighs 6.1 pounds, and includes a touch pad and 86-key keyboard.

There are the expected serial and parallel ports, a VGA connector, and one Type III PC Card slot. Also included with the unit are an IrDA panel and jacks for an external microphone and audio line-in/line-out on the back panel. Canon says the Innova Book's nickel hydride battery will last approximately 2.5 to 3 hours.

Canon Computer Systems Inc., Costa Mesa, CA; 800-848-4123, 714-438-3000; fax, 714-438-3317. *Circle 427 on reader service card.*

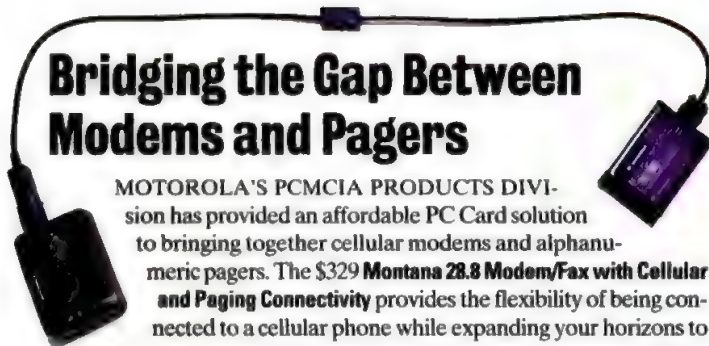


A PowerWave

POWER COMPUTING CORP.'S new proprietary technology, Stargate, is the unique feature of **PowerWave**, Power Computing's line of high-end PowerPC systems. Starting at \$3,448 and available with 120-, 132-, and 150-MHz PowerPC 604 CPUs, these mini-towers use Stargate to become the first MacOS-compatible systems to integrate the PCI bus, long a staple of the PC world, with NuBus. **Power Computing Corp.**, Austin, TX; 800-999-7279, 512-258-1350. *Circle 402 on reader service card.*

New & Improved

Bridging the Gap Between Modems and Pagers



MOTOROLA'S PCMCIA PRODUCTS DIVISION has provided an affordable PC Card solution to bringing together cellular modems and alphanumeric pagers. The \$329 **Montana 28.8 Modem/Fax with Cellular and Paging Connectivity** provides the flexibility of being connected to a cellular phone while expanding your horizons to provide connectivity to one-way alphanumeric pagers and Motorola's innovative, compact, two-way Tango pagers. The \$399 **Tango** pager uses ReFlex, a two-way transmission protocol that adds a 12.5-kHz response channel to a traditional paging system. Using Motorola's \$59.95 **Messaging Partner** software, you can send messages via phone lines to alphanumeric pagers, download messages from a Motorola Advisor or Tango pager, and send wireless messages via Tango pagers. Alternatives to Messaging Partner include Integra Software's \$40 **PC Beep**, which Integra says works across all brands of pagers, pager services, and modems. **Motorola PCMCIA Products Division**, Schaumburg, IL; 800-427-2624. *Circle 407 on reader service card.*

Motorola Paging Products Group, Boynton Beach, FL; 800-548-9954, 407-739-2000; fax, 407-739-3072. *Circle 439 on reader service card.*

Integra Software Inc., Greenville, SC; 803-627-5000; fax, 803-288-7770. *Circle 408 on reader service card.*

Converter for Your Pocket

UMAX TECHNOLOGIES' \$179 **Maxmedia TV Mini** is a pocket-size scan converter for taking any image displayed on a computer monitor and transferring it to a VCR or large-screen television; the device supports resolutions of up to 640-by-480 for NTSC and 800-by-600 for PAL. This VGA-to-TV solution has also eliminated some of the cables usually re-

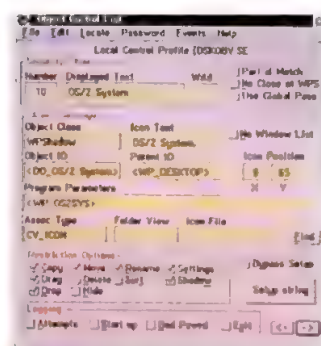
quired in such a setup; it provides a built-in VGA connector that plugs directly into the host computer's VGA card instead.

UMAX Technologies Inc., Fremont, CA; 800-562-0311, 510-651-4000; fax, 510-651-8834. *Circle 405 on reader service card.*



OS/2 Desktop Management

PINNACLE TECHNOLOGY'S \$179 **Desktop Observatory Version 4.0** helps make the lives of OS/2 network administrators a little less complicated. Desktop Observatory features a number of security options for the Workplace Shell and the OS/2 operating system. Network administrators can create and manage OS/2 desktops centrally from a server or host, provide audit control, restrain access to specified locations on the Internet, and restrict



OBSERVANT: Desktop Observatory assists OS/2 administrators.

groups of users to specific files. **Pinnacle Technology Inc.**, Kirklin, IN; 800-525-1650, 317-279-5157; info@pinnacletech.com. *Circle 406 on reader service card.*

In Pursuit of the Perfect Mouse

JUST BECAUSE A MOUSE IS BILLED AS ERGONOMIC DOESN'T mean that it's necessarily the right device for you.

Contour Design is onto something with its \$60 **Contour Mouse**. In view of the fact that one size does not fit all when you're dealing with a mouse, the Contour Mouse is available in three sizes. Although many mice feature a comfortable shape, the Contour Mouse's sleek form takes human physiology into account.

Both the tilted palm support and elevated wrist support help to reduce the force and stress on your wrist, thereby reducing the risk of carpal tunnel syndrome and other repetitive-strain injuries. The unique design also includes a comfortable thumb support and three customizable mouse buttons that are elongated so that you use your entire finger when clicking the buttons.

Contour Design, Lowell, MA; 800-977-1000, 508-937-2422; fax, 508-937-2722. *Circle 409 on reader service card.*



BRIEFS

Hardware

APS Technologies' \$299.95 **MobilStor Quad CD** is a multisession, external quad-speed CD-ROM drive that connects via the parallel port (816-483-6100) Performance Technology's \$4,195 **Instant Internet Version 3.0** is a hardware and software solution for simultaneous, direct connection of up to 50 network users to the Internet; the product now supports a 64K ISDN connection and a 32-bit Winsock (210-979-2000) U.S. Robotics' \$549 **Sportster ISDN 128K** is a PC-based terminal adapter that provides connection to ISDN-

based services (708-676-7010) Diamond Multimedia's \$289 **Diamond Stealth64 Video 2121 TV** multimedia accelerator comes with 1MB of DRAM. It combines 64-bit graphics acceleration and full-screen, digital video playback with TV tuning and video capture (408-325-7000) CalComp Input Technologies Division's \$150 **DrawingSlate II** is only 4 by 5 inches in size and weighs less than a pound (714-821-2000) AiTech International's \$299 **AiTech TVR-202** video-capture card provides a built-in, 125-channel TV tuner for full-screen, full-motion, scalable TV under

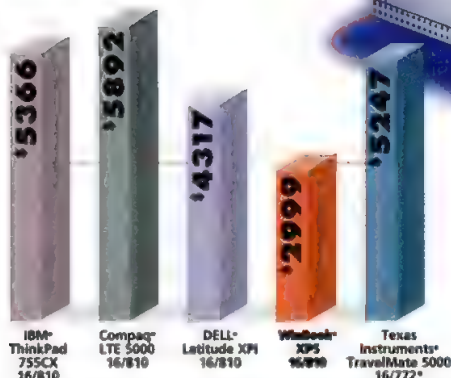
Windows, as well as radio reception and software that supports 99 preset FM stations (510-226-8960) Spectrum Signal Processing's \$299 **V.34 Office F/X** combines a 28.8-Kbps modem with a telephone management system for voice, data, and fax communications, wavetable audio support, and digital simultaneous voice and data (604-421-5422).

Monitors

ViewSonic's \$2,495 **PT810** 21-inch monitor features a flat, 19.5-inch viewable screen, an antireflection coating, and a high-contrast

PENTIUM® CHIP, LITHIUM, 16MB, TFT.

\$2999



Prices quoted over 1-800 lines as of 11/10/95 for identically equipped models with 75MHz Intel Pentium® processor, lithium ion battery, 14.4 fax/modem, and 256K cache, from IBM PCDirect, Dell Computer Corp., WinBook Computer Corp., Compaq Direct Plus, and Texas Instruments

* Includes two lithium ion batteries

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— January 1996

Winner of PC Laptop's annual Editors' Choice Award — the WinBook XP5 gives you the features you want in the highest quality, best value notebook. At \$2999, you get an amazing list of standard features including: Intel Pentium® processor, lithium ion batteries, 10.4" TFT active matrix screen, 16MB RAM, an 810 MB hard drive, and more.



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Great values on options begin with stereo sound, integrated touchpad or trackball, and 3-year extended limited warranty package. Call today about our \$2999 offer or for

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**DOCKING STATION
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**EXTERNAL CD-ROM
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- 40 Watts per hour Lithium Ion Battery
- 1MB Video RAM
- Two Type II or One Type III PCMCIA Slot
- Integrated Dual-button Pointing Stick, Optional Dual-button Trackball or Touchpad
- Parallel, Serial and PS/2 Ports

\$2999

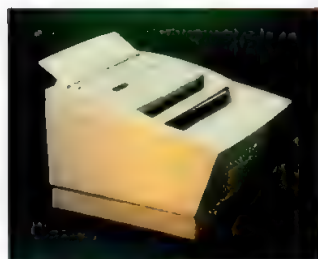
Other XP/XP5 models and price configurations available, starting at \$1999

More than Just a Printer

PANASONIC COMMUNICATIONS & Systems Co.'s \$2,495 **Sigma-100** goes beyond the functionality of a standard laser printer. This multifunction device incorporates a 6-page-per-minute, 600- by 600-dot-per-inch (dpi) plain-paper laser printer; a 400- by 400-dpi Twain-compliant scanner, and a 9,600-Kbps fax modem.

The printer includes 512K of memory, upgradable to 9MB, and PCL4 emulation. Dual output trays are provided for sorting documents.

The Group 3 fax features a 20-page automatic document feeder,



UNDER ONE ROOF: Panasonic's multifunction Sigma-100.

conditional dual access, and 15 deferred timers. If you receive an incoming fax while the printer is in use, or if it runs out of paper, the Sigma-100 will store the incoming transmission in memory for later retrieval.

Panasonic Communications & Systems Co., Secaucus, NJ; 800-742-4688, 201-348-7000. **Circle 410 on reader service card.**

Wireless Keyboarding

SEIJIN AMERICA, A COMPANY THAT HAS FORGED A NICHE in developing wireless keyboards, has applied the concept to its portable keyboard line. The \$99.95 **SPR-8630WP** is a compact, plug-and-



POINT AND COMPUTE: Seijin's compact wireless keyboard, the SPR-8630WP.

play wireless keyboard that works up to 20 feet away from the wireless receiver. The notebook-size keyboard packs the standard 101-key functions into its 86 tactile keys. The device works on two AA batteries and requires no additional software or drivers to run. All you do is

attach the wireless receiver, and you're off.
Seijin America Inc., Santa Clara, CA; 408-980-7550; fax, 408-980-7562. **Circle 411 on reader service card.**

Get a Head Start on Your Taxes

STOP GROANING. YOU KNOW IT'S INEVITABLE, AND IN FACT April 15 is closer than you think. There's no better time than the present to start thinking about the approaching tax season.

Intuit's \$39.95 **TurboTax for 1995** includes the final versions of IRS forms and allows you to file your taxes electronically directly from your desktop. The interface that guides you through the tax maze is now improved and more flexible. Integration with the Netscape Navigator browser and qualified free Internet access make it easy for you to obtain a variety of on-line tax information and services. The \$49.95 Deluxe CD-ROM version presents tax advice in a context-sensitive manner so that you'll get the answers to your questions when you need them. Tax modules are now available for every state.

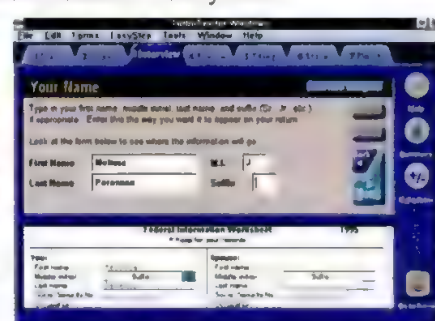
Block Financial Corp.'s \$39.95 **Kiplinger TaxCut** has been enhanced for ease of use. New features include: Kiplinger Tax Advice, which draws on the expertise of the Kiplinger organization; an improved interface; an interview session that walks you through filing your taxes; a rapid-find feature for locating reference information; and the automatic transfer of your data from your federal tax file to your state return (23 state editions are available).

Parsons Technology's \$19 **Personal Tax Organizer** helps you record and track tax-related data. Just enter amounts from your financial information and then conduct "what if" scenarios or export the data to Parsons' \$19 **Personal Tax Edge**.

Intuit Inc., San Diego, CA; 800-964-1040, 619-453-9446; fax, 800-756-1048. **Circle 412 on reader service card.**

Block Financial Corp., Kansas City, MO; 800-235-4060, 816-751-6000; fax, 913-438-3749. **Circle 413 on reader service card.**

Parsons Technology, Hiawatha, IA; 800-223-6925, 319-395-9626; fax, 319-395-7449. **Circle 414 on reader service card.**



A HELPING HAND: Intuit's TurboTax prompts you through the filing of a tax return.

BRIEFS

screen (909-869-7976) Sampo Technology's \$699 **AlphaScan 17mx** is a midrange monitor with a 15.8-inch viewable area, a streamlined look, and a maximum resolution of 1,280 by 1,024 pixels. For \$100 more, you can get the **AlphaScan 17gx**, which provides resolutions up to 1,680 by 1,200 pixels (770-449-6220).

Software

Index Stock Photography offers on-line access to an archive of over 500,000 professional stock images on the World-Wide Web (<http://www.indexstock.com>) Creative

Multimedia's \$50 **The Family Doctor, Fourth Edition**, upgrades the content and the interface of this at-home medical reference (503-241-4351) Pro CD's \$99 **Select Street Atlas** provides street-level and user-customizable maps, as well as the ability to integrate the included data sets with the maps (508-750-0000) Forget about the U.S. Mail—Seattle Film-Works is now delivering its **Pictures on Disk** service via the Internet (<http://www.filmworks.com>) Andover Advanced Technologies' \$100 **VideoCraft** is a 32-bit Windows 95 video-production tool with seven powerful effects

editors and Alpha Channel compositing for defining areas of transparency and opacity (508-635-5300) Intek Technologies' \$495 **Vivid Clarity 1.1** assists application development through its data modeling and rapid prototyping functions that can reengineer existing databases (800-654-3249) PHH Fantus Consulting's \$4,500 **Location Quest** helps you search for new corporate-facility locations by offering "what if" scenarios and over 900 demographic, geographic, and user-defined variables that can determine the site for you (201-301-0234).

When you just can't get enough...



Disk space, that is.

Today's computer users just can't get enough. Storage demands are growing out of control. Finally a storage system you'll never outgrow... the Pinnacle Micro Apex 4.6 Gigabyte Optical Hard Drive. Go ahead and store it all - no worries. Fill up a disk, just add another. Each optical disk holds 4.6 Gigabytes of all kinds of stuff. All the graphics you can create. Run your favorite CD-ROM titles at 16X speed. Backup data like accounting records, business plans, and images with compression up to 10 GB per disk. Store all the high resolution color images,

CAD/CAM files, or documents you could ever want at the speed of hard disk drives. And, it's affordable at only \$1695 with one free disk. Additional optical disks are just \$199 with a guaranteed shelf life up to 30 years. The Pinnacle Apex 4.6 GB Optical Hard Drive. The ultimate storage machine. Remember, you can never be too rich, too thin or have too much disk space. To order or for a local dealer call: **800.553.7070**



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It copies.

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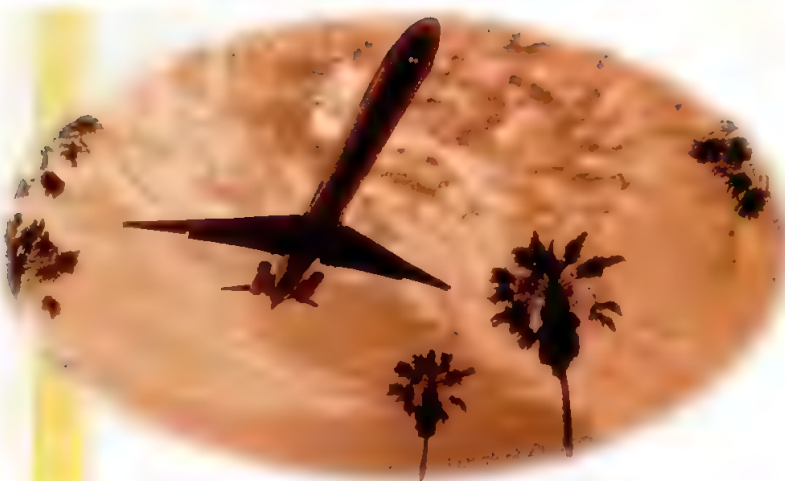
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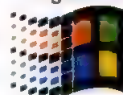


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TVs and Computers: Collision Course

Convergence is happening whether I want it to or not. I've railed against it enough times to make me persona non grata at the Consumer Electronics Show. I've derided a variety of dumb notions, from interactive TV to television-based computers. For

the record, though, let me restate my position: Computers are active; television is passive. We hold these truths to be self-evident; that all people are entitled to veg out in front of the tube, whether for the latest episode of *Friends* or *Monday Night Football* or reruns of Julia Child's cooking show on PBS. Whether the show you're watching makes your heart pound or induces narcolepsy, it's still passive, with no decisions or efforts on your part beyond the initial choice of program.

Computers, by contrast, require you to make constant choices, decisions, actions. Whether it's a hot game, an online chat, or a breakdown of your checking account, you're always evaluating what you see on the screen and causing something else to happen—active involvement. By comparison, TV is a really, really good screensaver.

TVs and computers are not natural enemies once you get past the vastly different ways that they are used. In contrast to Bruce Springsteen's assertion, "57 channels and nothin' on," there's quite a lot on. The first challenge is to find it. The second challenge is to shift it via VCR to a time when it would be convenient to watch it. Computers can help.

You even have a choice of technology. You can be wired or hardwired. TVNow is the coolest guide to TV shows ever to hit your hard disk. You download (or have mailed to you) detailed, monthly program listings. Not only do you get the mundane listings of everything on your broadcast and cable systems, but you can use your computer's inherent power to sort and select the shows you want to see. TVNow's database is sufficiently sophisticated to let you select movies by actor or director in addition to the more usual "It's Friday—what's on?" queries. Your subscription to TVNow gives you a password for the month's full listings, but you can try a shareware, movies-only version of the service at www.tvnet.com/TVNow-tvhow.html.

Video Guide (800-848-4331) harnesses computer power in an entirely different way. A precursor to intelligent set-top boxes, Video Guide is dedicated hardware

that installs between your cable box and TV. Infrared emitters control your TV, VCR, and cable box. Video Guide gets its listings from transmissions on the same frequency as pagers, via a stubby little antenna atop the unit. Instead of looking on the computer screen for listings, you

look right there on the TV. The display—thanks to the intelligence in the box—is far more useful and interactive than the dumb-as-a-rock scrolling displays provided by your cable company.

Granted, Video Guide can't hold a candle to TVNow when it comes to searching and sorting, and it gives you listings only for the next seven days. But it has some noteworthy abilities, not the least of which is the ability to program your VCR to record any show on the guide. It understands the difference between 5-day and 7-day repeat cycles, too.

Video Guide has some other capabilities that should make the cable companies sit up and take notice. It receives news, sports, and local weather continually. Easy menu choices let you select the news stories that interest you most; heuristics inside the box sort future news stories by topic, so you see the topics that you care most about first. Sports scores are updated within minutes, and game summaries are available the next day.

You control Video Guide, your TV, cable box, and VCR through an innovative universal remote control with a thumb-size joystick. Video Guide's designers compare the product's power and

technology with an original 512K Macintosh—not bad for a \$99 piece of gear.

Dedicated hardware and software usually win out over general-purpose designs, but TVNow's search capabilities make it all but indispensable when you're looking for the next airing of a movie that you missed. If TVNow integrated with your VCR, there would be no contest. PCs can control infrared devices, but the effort and expense are too great for all but the most dedicated videophiles. If the IRDA port on my Gateway Liberty subnotebook could control my video system, I'd be tempted to keep it in the family room all the time, with TVNow on the screen. □



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Internet Insanity

It's been a weird few years, made all the more confusing by the impact of Internet promoters and their ilk. Look at what we've gone through recently. It's a battle between the computer and the Internet. Right now, the Net is winning, but it won't be for long.

The scene is currently dominated by what I call the *Internet mentality*—and it's a doomed way of thinking.

The Net promoters include companies such as Sun Microsystems, which are looking to sell more hardware just for Internet connectivity, scads of small software startups, and Netscape, the Internet's heavy-weight. Jim Clark has become the fastest zero-to-a-billion rich guy in the world. Top all this with the mania in the stock market generated by any company that so much as mentions the word *Internet*. Wham! It doubles overnight. All this proves to me is that the boneheads on Wall Street are as dumb as they were in college when they had to switch their majors to business to keep from flunking out.

This is exacerbated by a slew of books, from every two-bit guru and pundit, predicting how we'll all be using the Internet to order pizzas by this time next year. Even Bill Gates's dull tome *The Road Ahead* made the best-seller list—after the PR machine put him on every TV show in America, that is. Gates, who is not network-oriented, was forced to blow the Internet horn along with the rest of them because it sells books. It sells stocks, it sells books, it sells itself.

What happens when reality sets in? Most serious Internet/World-Wide Web users aren't as jazzed about all this stuff as the readers of *The Wall Street Journal* are, let me tell you. As a serious vehicle for research and a usable backbone for e-mail and discussion groups, the Internet is fine. It works. But as a substitute for on-line services, it stinks. The only advantage it has over on-line services is that it's much cheaper. You can spend a lot of time waiting for your machine to connect to a Web-page server and an even longer time downloading a screen full of graphics. With an on-line service you'd be on and off in much less time. If time means nothing to you, then surf the Web.

My concern is that if high-flying Internet stocks do fall, they'll take all the high-tech stocks down with them—and perhaps prompt the collapse of the whole market. This pathetic tail-wagging-the-dog scenario frightens me. I'm not looking forward to the next depression.

To make matters worse, the computer-technology side of the battle is somehow being lost. Last Christmas, people were moaning about the "high prices" of computers, despite large price cuts and major advances in technology: 1994's high-end machine was a 66-MHz Pentium with a 500MB

hard disk and 4MB of memory. This year, we're looking at 75- to 125-MHz Pentiums with lots of memory, internal CD-ROMs, sound capability, and gigabytes of hard disk space—all for a couple of thousand dollars. Even these hottest systems are still getting a lukewarm reception.

What's happened? The Internet mentality has crept in. It's a something-for-nothing way of thinking. Free e-mail. Free information. Cheap, cheap, cheap. Anyone who tries to make money on a site is hacked by a group of anarchists. The Internet mentality says that computers should also be cheap, cheap, cheap.

This is why there's such a buzz around the dopey concept of a \$500 Internet terminal computer: It won't be free, but it'll be cheap. And to heck with expensive applications. You'll be able to run Java applets and it won't cost you a cent.

Of course, anyone who buys one of these turkeys will discover the same thing that impatient Web users discovered about the Net just before switching to an on-line service: You get what you pay for. Either these Internet-terminal

computers will end up as doorstops, or some smart cookie will find a way to connect them to the real computer in the house—making them the diskless terminals they were from the beginning. And as for the people who think that Java applets will replace real software, you have to wonder what they are smoking nowadays.

The socialist and utopian something-for-nothing mentality of the Internet culture can't last long. At the base of the computing battle is the need for increased personal productivity (not for free products). This means more powerful computers, more powerful applications, and easier and faster information access. This simple concept has been lost in the shuffle. The Internet has a role to play, for sure. But it's a role as a tail—not as a dog.



NETOPIANS

The Internet mentality has crept in: a something-for-nothing way of thinking.

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Inside Track

What ever happened to the **dead-end fad** of upgradable CPUs—Intel's OverDrive, to be exact? I was amused as I read a *Newsbytes* report about how Intel admitted having fouled up the Asian market for OverDrive chips by trying to convince them that it was a **good idea** to sell fewer new machines and instead get their customers to buy an Intel add-in **OverDrive chip**. Apparently, Intel figured out that this was a dumb idea. These chip guys are wacky.

Consumer Alert Dept.: Every time I mention something like this I get a bunch of hate mail. Stop shooting the messenger. Insiders at the major game companies now tell me that by the end of this year many of the best CD-ROM-based games will simply **not function properly** on anything less than a quad-speed CD-ROM drive. Already there are games coming on the market that are optimized for the faster drives, although they will work with slower drives. They'll just drop a lot of frames.

The **irony** is that many of the CD-ROMs made using older processes or done at **mediocre** pressing plants do not work well with 4X and 6X drives. I have been looking at a lot of CD-ROMs and found numerous disks with this problem. Unfortunately, you can't slow down the fast drives—an idea that should be studied. I believe as drive speed increases **this will become a bigger problem**, especially with old CD-ROMs. Since people do not like to discard CD-ROMs, manufacturers should look at the concept of **gearing down the fast drives** of the future. It will be interesting to see how the makers of the upcoming SD Disk will handle this, since most are expected to be backward-compatible with the CD-ROM technology of today.

New Players Dept.: Since most games now ship exclusively on CD-ROM, it's unlikely that we'll see any more machines that don't come equipped with a CD-ROM built-in. The bigger issue is with laptops. Can a CD-ROM drive be invented that is small enough to slip into a laptop without adding much weight or size? This is the type of design work at which the Japanese have excelled. When I was at Comdex the most interesting CD-ROM drive there was an inexpensive **5-disk changer from Panasonic** for desktops. What made this unit so compelling is that the entire system fit into a half-height drive bay. Zounds. I've been using the Pioneer 6-disk changer, which employs that handy 6-pack cartridge, but it's a **behemoth by comparison** with this thing. If you have a nice tower system, you'll be tempted to drop

*Some say that Sony is
trying to get enough
of a feel for the market
that it can decide whether
or not it wants to buy
Apple Computer.
There are rumors
that AT&T and IBM
are both interested, too.*

three or four of the Panasonic 5 disk units into it for 15- to 20-disk capacity. There is no question that people need multiple-disk access without swapping.

Interesting Technology Fall-out Dept.: Here's something to look for. Because blue-laser technology can pack more information than today's best optical drives, more powerful blue lasers have been developed. Blue lasers have a shorter wavelength than the red lasers used to make today's 650MB disks. This means they can make more compact storage pits on the disk's surface and therefore squeeze many times more data onto a single disk. Coincidentally, it was because there was no adequate blue laser that it was impossible to make a color hologram. Now that blue lasers

are available along with green and red (RGB: get the picture?) expect to see some **stunning 3-D holograms**.

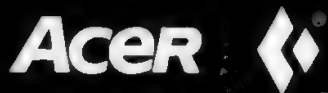
More Japanese Getting into the Act Dept., or How Soon They Forget Dept.: Did anyone **raise an eyebrow** when Sony made the announcement that it will ship "its first personal computer" later this year? Am I the only one to recall its earlier personal computer back in the eighties? Or did that **floperoo** not count? Anyway, Sony stopped making that machine and, a few years ago, was going to set the world on fire with a Workstation (a personal computer of sorts) that sold poorly and was discontinued. Trying to deny the past isn't going to help. The irony is that the Sony machines—both its first PC and the Workstation—were well-engineered, quality products. Sony, sorry to say, has no clue about marketing computers. Saying that this latest effort is its "first personal computer" when it isn't is but **further proof** of this bumbling.

Curiously, Sony's engineering will be minimal, since it seems as if the company will simply play me-too and use the Intel motherboards. It's interesting to note that just as Sony is getting into the PC business **via the Intel motherboard** that Insight, the Tempe, Arizona-based mail-order house, is getting out of the PC business. It, too, used Intel motherboards and simply attached its name. If a low-overhead direct-marketing company like Insight can't make a healthy profit selling these clones, how will Sony manage?

Conspiracy Side. Some say that Sony is trying to get enough of a feel for the market that it can decide whether or not it wants to **buy Apple Computer**. There are rumors that AT&T and IBM are both interested in Apple, too.

The IBM rumor may be on the money, since the company needs some sort of **non-Microsoft** popular operating system for its PowerPC machines. The likelihood that OS/2 for the PowerPC will ever see the light of day looks **bleak**. □

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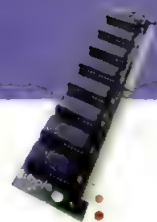
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The Case of the Wasted Clusters

All right. *All right!* Turn off the bright lights, copper. Put down the rubber hoses. I'll talk. Last fall, in "Don't Get Giggled" (October 10, 1995), I said you shouldn't consider buying anything less than a 2GB hard disk, and that ultimately

you'd be a lot happier with a 4GB disk. The column triggered a small mountain of mail. A few letters said I was nuts: One correspondent said that his 30MB drive was still less than half full; he was pretty sure—and rightly so—that he'd missed something somewhere. Others thanked me for the advice. But the real spark was the last part of the column, where I suggested, in the name of efficiency, paying close attention to how you divide all those gigabytes into logical drives.

I recommended Jeff Prosis's excellent PC Tutor column in our issue of June 27 for background on logical-drive partitioning, and gave a few of my own guidelines for chopping up big drives into manageable partitions.

But that wasn't enough. *Nooooo.* Zillions of readers wrote to say, in the words of one correspondent, "C'mon, what's the real story? Why partition a drive at all? What do you do on your PC? I want the inside secrets. Or else."

Or else? Well, yessir, lemme see here. Okay, here's the inside story. It ain't pretty, officer, but it is important.

Both the file allocation table (also known as FAT) used by DOS and the VFAT file system used by Windows 95 allocate file space on your hard disk in clusters. The maximum number of clusters is 65,536, so as the disk size increases, the size of each cluster increases. The smallest clusters are 2K, the largest, 64K. The breakpoints for increases in cluster sizes are: 128MB or less (2K), 256MB (4K), 512MB (8K), 1GB (16K), 2GB (32K), and 4GB (64K).

Small clusters make the most efficient use of space on a hard disk. That's because as the operating system stores a file on the disk, it can use only whole clusters. What this means is that a 9K file takes two 8K clusters on a 512MB hard disk—and presto, you've just wasted about 7K of disk space.

So is the answer to set up a lot of small 2K clusters? The only way to get down to a 2K cluster size is to use hard disks of less than 128MB, or multiple smaller-than-128MB partitions—"virtual disks"—on a larger hard disk. But that's too limiting. For one thing, a file must be stored entirely on one disk, and these days, lots of us use files larger than 128MB.

Moreover, with some Windows 95 apps demanding more than 128MB on a single disk just to install the program, using lots of small virtual disks is often impossible. Finally, chopping a big 2GB or 4GB disk into lots of little, sub-128MB virtual disks creates a nightmare of drive letters.

Divide a 2GB disk into 15 127MB virtual disks and you'll use C: through R:. Forget about network drives. And oh yes—is that font utility on drive L: or drive Q:?

Going to the other extreme—using 2GB partitions, the largest supported under current versions of DOS—means dealing with inefficient cluster sizes, but it may be worth it in terms of your *own* efficiency. In fact, if your disk will be used to store fewer but larger files (where the waste is less significant) instead of many small files (with a lot of waste from the many files slightly too large to neatly fill the clusters), you have a real incentive to use large to very large partitions.

As much as I like getting my money's worth by making the most efficient use of hard disk real estate, I'll accept the inefficiency of large clusters as a price worth paying for the convenience of fewer but larger virtual disks. But this, too, varies with the purpose of the machine. On notebook PCs—where I can never get enough storage—I use 4K or 8K clusters. On the desktop PC I use for writing, I use 16K clusters. And on the PC I use for composing, recording, and editing music—with truly huge files—I use 32K clusters. Note that it's important to stay just *under* those

breakpoints I listed; a 511MB partition uses 8K clusters, but go up just 1MB to 512MB, and you're into 16K clusters.

Two important exceptions to all this: Windows NT's NTFS file system limits clusters to 4K, regardless of disk size; OS/2 Version 3.x's HPFS uses fixed, 512-byte sector sizes, which makes for efficient disk usage even with many small files. And if you use data compression programs like DoubleSpace, DriveSpace, or Stacker, this whole discussion is moot, since disk compression retrieves the cluster-overhang space that is otherwise wasted.

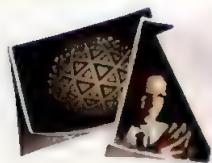
That's it. That's all I've got to say, copper. Now turn those lights down. And hey—you got a smoke? ☐



DISK DECISIONS

If you're storing fewer but larger files instead of many small files, use large partitions.

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USB: The Next Stop for PCs

Life is full of opposites. In the PC industry, a thick cable bristling with dozens of pins doesn't translate to a bigger, faster data pipe. It just means older technology: Witness the parallel cable and the serial cable. Two technologies emerging this year

have the potential to kill off parallel cables, serial cables, and SCSI cables—virtually everything on the back of your PC except the VGA connector and power connectors.

These two standards-in-the-making are Universal Serial Bus (USB) and IEEE P1394 (nicknamed FireWire), and the jockeying between the two was one of the most notable points of the annual fall Comdex trade show in Las Vegas. Both USB and P1394 promise to connect multiple I/O devices to your PC at high speed using thin cables and small connectors. I believe the two are complementary, not competitive, and ultimately you'll have both on your PC and laptop.

USB is the one that's cheap and guaranteed to happen this year, in part because its chief adherents are Intel and Microsoft, the industry's 1,600-pound-gorilla tag team. USB provides 12 megabit-per-second bandwidth, roughly the same as Ethernet. The connector is a flat, four-pin affair. The signal is good for 5 meters per segment, you can plug and unplug devices without powering down the system, and you can have up to 127 devices connected directly to the PC or to hubs on monitors or keyboards. About 100 vendors have signed on to provide USB products.

Likely candidates for USB are keyboards, mice, and joysticks, followed by printers, scanners, and external modems. One major advantage of USB is that it supports telephony devices including ISDN adapters and PBX switching. By mid-1996, Intel will build two USB jacks onto the PC motherboards it supplies to the industry, and you'll see them sold on PCs in the third quarter. As for cost, everyone I've talked to says: "Trust us. It'll be buried in the cost of the system." The USB logic will be built into most system chip sets, and the connector costs about a dollar.

P1394 starts out with the catchier nickname (it's a treat to hear "FireWire" pronounced by Southerners) and better performance specs, but FireWire is playing catch-up—if you believe the two are locked in some kind of only-one-can-survive combat, which I don't. P1394 is rated at 100 MBps, 200 MBps, and 400 MBps, and its most likely application is for devices that currently use SCSI: hard disks and CD-ROM

drives as well as high-end digital video applications. Sony sees FireWire as a link between PCs and consumer electronics. At Comdex it showed a PC controlling and sending signals along a wall full of audio/video gear. Other backers include Adaptec, the SCSI standard-bearer, and many of the

semiconductor companies who could make P1394 chips. P1394 uses six wires, including one pair that provides up to 40 volts of power (USB provides power, but not as much). Each segment can go 4.5 meters, and longer versions are planned, but P1394 probably won't appear on systems until 1997, when there are mainstream products that use FireWire.

When USB first shows up, PCs are likely to drop from two serial ports to one port. I would look askance at any vendor that rushes to drop both serial ports and the parallel port in favor of USB only. (Remember that it took five to six years from the introduction of the 3.5-inch floppy disk drive in 1987 to the final departure of the 5.25-inch floppy disk drive.) The adoption of USB and FireWire also spells the demise of two competing peripheral buses: Access.bus, a 100 Kbps scheme, and GeoPort, Apple's 2-Mbps I/O Bus.

For those of you who want to retrofit your existing PCs, add-in cards will provide USB and P1394 support, with minor limitations. For example, USB devices wouldn't be accessible until after boot time, which rules out using a USB keyboard. You'll also be able to buy USB-to-serial and USB-to-parallel converters in

case you wind up with a new PC and old I/O devices.

The big win with USB (and eventually FireWire) will be the ability to customize your PC in the office or at home. You'll be more likely to have a keyboard and mouse for the adults and a separate child-size keyboard and trackball for the kids, all plugged in at the same time, all functional. Or you can have a mouse and a digitizing tablet attached. You'll also see the market grow for niche products whose popularity is currently hampered by the lack of free I/O ports: label printers, business card scanners, and hand scanners, for instance. I think these products add immense value to the office. Now, there's a way to connect them easily. □



PLUG AND PLAY

The big win with USB and FireWire will be the ability to customize your PC at work or at home.

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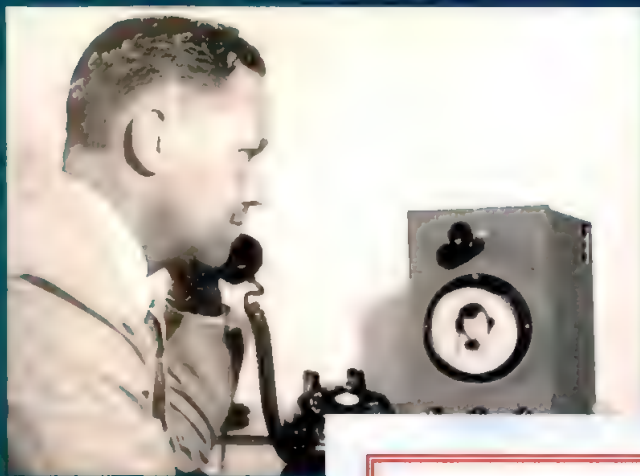
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CIRCLE 076 ON READER SERVICE CARD

NETWORK EDITION

MULTIPLEXERS

Divide and Conquer

Now your company can communicate like the big guys. A sub-T1 leased line—plus a low-end multiplexer—boosts connections.



By Les Freed

If your company has more than one business location, you may be wasting money—lots of money—on communications charges. Typically, companies with several locations install a leased line for interoffice LAN or data communications, but they often continue to rely on dial-up analog telephone lines for voice and fax communications between the home and branch offices.

ILLUSTRATION BY PETER COATES

INSIDE



The once subtle trend isn't so subtle anymore. Your networking and telecommunications needs, which have been edging ever closer, are now getting pretty much entwined. This has long been the case for big business, and the momentum is beginning to pull in medium-size and small companies.

IN OUR COVER STORY, veteran telecommunications and network specialist Les Freed test drives some products that help you manage this trend. Multiplexers are nifty devices that make the most of the bandwidth you get when you finally move to a dedicated leased line for your company's wide-area communications.

THESE MULTIPLEXERS COMBINE all your phone, fax, and LAN signals into one efficient signal for transmission. We tested multiplexers that cater to a growing new market segment—those for sub-T1 speed lines. Freed confirms that you'll likely require a consultant's help.

IN FIRST LOOKS, CHUCK LIN reports on another vendor focused on carrying some of the Mac's finesse over to PC networking. Two remote-access products from Tribe Computer Works carry some user-friendly traits. But their lack of support for IPX—in favor of IP and AppleTalk only—won't carry them in some shops. (Page NE17.)

CONTRIBUTING EDITOR Steve Rigney reports on WinFrame for Networks, from Citrix. This compelling package requires a healthy Windows NT server, but it makes more than the most of your old DOS-based PCs for remote control, remote node, and more. (Page NE17.)

IN MULTIPLE ACCESS, get Frank Derfler's take on who your future provider of telecommunications services is likely to be—or not to be. (Page NE28)
—Gail Shaffer

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—PC Magazine, January 10, 1995

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DELL	8.4	8.0	8.1	7.8
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CIRCLE 924 ON READER SERVICE CARD

Long-distance telephone calls are prohibitively expensive, especially during prime business hours. A leased-line connection is a relatively inexpensive alternative, but until recently, you needed separate leased lines for voice/fax, data, and LAN traffic. The cost and inconvenience of maintaining multiple leased lines often outweighed the savings.

The only solution was to use a leased-line multiplexer—a device that helps you use your leased communications lines far more efficiently by using one leased line for all your interoffice communications. Unfortunately, those devices were available only for expensive, high-speed lines, such as T1 links. But now, the advent of a new, smaller breed of multiplexer changes that. These new lower-end devices streamline your communications, reduce your costs, and add capabilities.

This roundup covers sub-T1-speed multiplexers—specifically, devices that operate over a 56-Kbps link. The three solutions we review here—Data Race's MACH DS plus 04, Micom's NetRunner 75E Integration Router, and two Access Plus Integrated Access Multiplexers from PCSI—are multipurpose multiplexers that can operate over a variety of leased lines. Although 56 Kbps may not seem like enough bandwidth to carry voice, data, and LAN traffic, we were pleasantly surprised by how well these units performed.

Today, virtually all multiplexer vendors offer LAN-to-LAN connectivity solutions. Many also provide unified voice/data/fax solutions such as the ones offered by the three vendors reviewed here. (Two other vendors—Multi-Tech Systems and Newbridge Networks—make similar products but could not provide units in time for our tests.)

As you might expect, installing a multiplexer is not a plug-and-play operation. Because the multiplexer connects to both the LAN and the PBX systems, the installation must be performed by a specialist who is familiar with both.

Typically, these products are sold through value-added resellers (VARs) that provide installation as part of the cost of a unit. There are literally hundreds of configuration options available, so you should plan to sit down with the VAR and go over an installation checklist before the installation begins.

NetRunner 75E Integration Router

Typically, a company's market share depends on your point of view—how you count and whose numbers you grab. But however you slice it,

Micom Communications Corp. has been a leader in the multiplexer market for a long time. Its experience gives it an edge in the new low-end multiplexer field.

Micom's NetRunner 75E Integration Router is the cream of the crop. In addition to its excellent routing capabilities, the NetRunner I-Router's great all-around performance comes from the careful attention Micom has paid to network management details—an increasingly important concern with

internetworking products.

Micom has also built some impressive extra features into the NetRunner I-Router, such as the intelligent handling of fax transmissions to conserve bandwidth.

Data Race and PCSI hold their own with good multiplexer solutions. There were no losers here. You'll be seeing many more vendors jumping into this segment of the market as businesses continue to demand more and more of their wide-area links.



MULTIFACETED

To illustrate how a multiplexer works, we created an imaginary company with a main office in Tampa and a sales office in San Francisco. The branch office has its own LAN and PBX system and is connected to the Tampa office via a 56-Kbps leased line.

By connecting the multiplexer to the PBX system at each location, users in any city on a network can direct-dial their coworkers in any other city on the network. As a bonus, users in any city on the network can make outgoing calls anywhere in the other cities' local calling areas with no toll charge. Users on any PC can connect to any server, and they can print to any printer on any of the connected LANs.

Under the hood, these multiplexers use some very sophisticated hardware and software to combine the various signals. Analog audio from the telephone and fax connections is converted to digital form and combined with the data stream from the LAN, serial ports, or both. The combined data stream is shipped out over the leased line to the multiplexer at the other end of the line. The combined signals are then extracted from the data stream and converted back to their original forms.

Network and voice traffic are what multiplexer manufacturers call "bursty" traffic, meaning that they consist of large chunks of data intermingled with periods of silence or no data at all. All of the units we tested were able to take advantage of this fact by reusing unused bandwidth from one signal to improve the speed of another.

LAN users will tolerate some time delay, but telephone users expect voice conversations to take place in real time. All three of the units we tested give priority to voice traffic, and all three utilize data-compression and silence-suppression techniques to minimize the bandwidth required for voice traffic. As a result, the data throughput scores on our benchmark tests varied according to the amount of voice and fax traffic on the line.

Although these units are complicated to set up, they are very easy to use. Because they connect directly to the existing phone system, users don't have to do anything special to call a remote office. They just dial the assigned extension number for the person they want.

For the units we tested, voice connection quality was excellent—quite similar, in fact, to that of a regular dial-up line. We made several test calls through the multiplexers to a variety of in-house, local, and long-distance numbers with no noticeable distortion or delay.

Similarly, we found LAN connections to be seamless; the remote server and printer simply appeared at the other end of the leased line. There was some difference in speed, of course; the data link is running at

These new multiplexers can operate over a variety of leased lines and add capabilities such as routing and bridging.

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Native Oracle™ & SQL Server interfaces	Yes*	No
True object-oriented code reusability	Yes	No
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Multiplatform: Windows, Macintosh, OS/2**	Yes	No

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How a Multiplexer Helps Your Business

Multiplexers make the money you spend on a 56-Kbps leased communications line go a lot farther. The multiplexer, in effect, splits up the line to accommodate voice, data/fax, and LAN traffic. Users at each of your remotely situated sites can make calls to the other sites as if the calls were local, and your wide-area LAN traffic moves more reliably



56 Kbps, and LAN traffic moves slowly. You wouldn't want to load large applications (like Microsoft Excel) from a remote server over one of these links. But even at 56 Kbps, the connection is well suited for routine LAN tasks such as copying files, printing documents, and exchanging e-mail.

The bottom line? These units can actually pay for themselves over a relatively short period of time. If you have or are planning to install a LAN-to-LAN bridge, these multiplexers provide free interoffice phone and fax service for a very small equipment investment.

Data Race Inc.

MACH DS plus 04

ALL REVIEWS BY LES FREED

Flexibility is the hallmark of Data Race's MACH DS line of multiplexers, which range in size from 4 to 64 user ports. Each user port can be assigned to an Ethernet, serial, or voice/fax connection. We tested the \$2,045 MACH DS plus 04. Our test unit held two \$1,895 voice/fax cards and one \$1,195 Ethernet interface, bringing the total cost to \$7,030.

Each of the three standard serial ports on the MACH DS units can be configured for synchronous, asynchronous, or link ports. This flexibility allows you to start out with either a single 56-Kbps link (with the ability to add links later for more bandwidth) or an initial three links. In our test configuration, we used a single 56-Kbps link port to connect the Plus 04 to our line simulator.

Data Race offers an optional Ethernet

interface card that has both 10Base-T and AUI connectors. This option creates an Ethernet bridge across the link. No routing functions are provided, so any Ethernet traffic arriving at either unit will be transmitted to the other end. If you have more than a few Ethernet addresses on either side of the link, however, you'd be wise to invest in an external router to reduce unnecessary traffic. If you install a router, you can omit the Ethernet bridge card and connect the router to one of the synchronous serial ports. We tested the Plus 04 using the supplied Ethernet bridge.

The products employ fast-packet technology, which assigns voice data a higher priority than LAN traffic. Thus, voice quality across the link was very good, with only a slight processing delay.

The Plus 04 performed well, averaging 70.5 Kbps in raw throughput. The 4,800-bps fax test dropped throughput to 66.3 Kbps—a drop of 4.2 Kbps. The voice torture test dropped throughput down to 46.9 Kbps, a decrease of 23.6 Kbps from the raw throughput score. These numbers place the Plus 04 in the middle of this threesome.

Of the solutions we tested, the Plus 04 was the only one that provided meaningful status and diagnostic LEDs on the front

panel. We found these LEDs especially helpful during installation.

Data Race offers a wide variety of add-in cards for the MACH DS series, including dial-up and leased-line modems, as well as an internal CSU/DSU for connecting directly to a 56-Kbps leased line.

We liked the Plus 04's flexibility. And the ability to add another link at a later time is a big plus—especially if you suspect your interoffice voice and data traffic is likely to increase over time, as it probably will.

MACH DS plus 04. List price (varies with configuration): Basic unit, \$2,045; dual voice/fax line card, \$1,895; Ethernet bridge card, \$1,195. Data Race Inc., San Antonio, TX; 800-329-7223; 210-558-1900; fax, 210-558-1929; mktgsales@datarace.com. Circle 953 on reader service card.

Micom Communications Corp.

NetRunner 75E Integration Router



Outstanding performance, integrated routing, and great management features make Micom Communications Corp.'s NetRunner 75E Integration Router an excellent choice for companies looking for an easy way to consolidate their communications links.

Although Micom calls it a router, you can think of the NetRunner I-Router as a

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BENCHMARK TESTS

Multiplexers



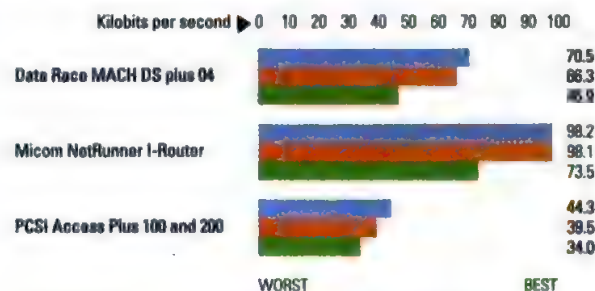
Differences in design made for some differences in performance. The NetRunner I-Router, with its built-in routing, did well on all of our tests.

The Access Plus solution, though slower, handles voice especially well.

We created two separate testing environments at PC Labs to simulate the typical situation in which these multiplexers would be deployed:

device. In the real world, you'll need additional hardware—a CSU/DSU (channel service unit/data service unit)—to connect the multi-

■ Raw throughput ■ Throughput with fax ■ Throughput with voice



connecting a small branch office to a larger main office.

Our branch-office environment consisted of a two-node NetWare LAN, a telephone, and a fax machine. The main-office side was a bit more complicated: an AT&T Definity PBX system with phones, outside lines, and a fax machine attached, as well as another NetWare LAN.

Our simulated offices were connected via a 56-Kbps communications link, simulated by an Adtran communications

plexers to the leased line.

When we run comparison tests, we prefer to test products under identical conditions. These three solutions presented a challenge, since each handles network data in a different way. So we had to alter the test environment slightly for each product. The common thread is that all three were connected via the same 56-Kbps digital-line simulator, and to the same test LANs and phone system.

\$2,450 voice/data multiplexer with built-in routing. Its single communications link places the NetRunner I-Router at the low end of Micom's extensive multiplexer line, although it can connect to any of Micom's main-office routers.

The NetRunner I-Router's router works with most major network protocols, including IPX, IP, and AppleTalk. The router automatically configures itself. Within a few minutes of initial power-up, a new NetRunner I-Router will have

learned the Ethernet address of every device on the LAN. The connected NetRunner I-Routers periodically exchange their routing information across a wide-area link, so that each router on the network always knows where any given Ethernet device is located.

The NetRunner I-Router comes with three serial interfaces and one Ethernet port. Two of the serial ports are synchronous, and one is asynchronous; one of the serial ports can also be used as a backup

The Micom NetRunner 75E Integration Router comes with a built-in Ethernet router, and our test setup made use of the unit's routing capabilities.

The Data Race MACH DS plus 04 has 10Base-T and AUI Ethernet connections on the rear panel. All Ethernet traffic sent to the unit on either end will be transmitted to the other end. This creates an Ethernet bridge with no routing capability.

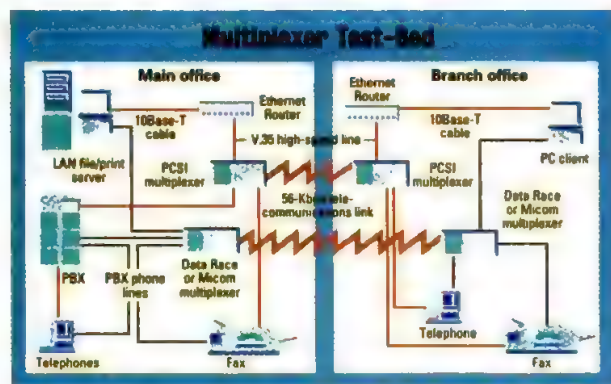
We tested the Plus 04 as an Ethernet bridge. If you have more than a handful of remote devices, though, you'll need a router to reduce unnecessary data traffic over the multiplexed link.

The PCSI Access Plus setup doesn't provide an Ethernet bridge per se, but it does provide a high-speed serial data link. We used a Cisco router at each end of the link to convert the LAN Ethernet data to V.35 synchronous serial data. We connected the Cisco routers

to the PCSI multiplexers via high-speed V.35 serial connections. This setup provided essentially the same LAN functionality as the NetRunner I-Router.

We tested each solution at PC Labs in three different ways using the NIC Throughput test from NetBench 4.0. We measured the **Raw Throughput** of each multiplexer solution by sending 32K blocks of random data over the link for 5 minutes. To determine the **Throughput with Fax** score, we repeated the same process while sending two very dense fax pages at 4,800 bps. The **Throughput with Voice** score represents the data throughput measured in the same way but with a simultaneous voice conversation.

We used a female speaker, because female voices require more bandwidth than male voices, thus making the test more demanding. (Our thanks to Amy Leung for reading the same text over and over.)



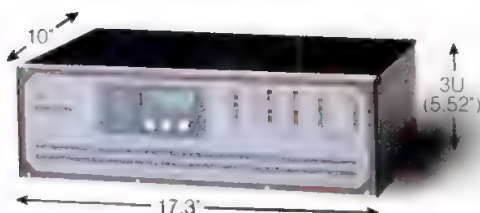
link port. This means you can use a modem on a dial-up line as a backup if the main 56-Kbps line goes down. The Ethernet port supports 10Base-T and AUI connections. The unit we tested also contained an optional \$1,800 two-port voice card.

At PC Labs, the NetRunner I-Router turned in some impressive scores, providing nearly 25 percent better throughput than the next-best unit. In raw throughput, the NetRunner I-Router

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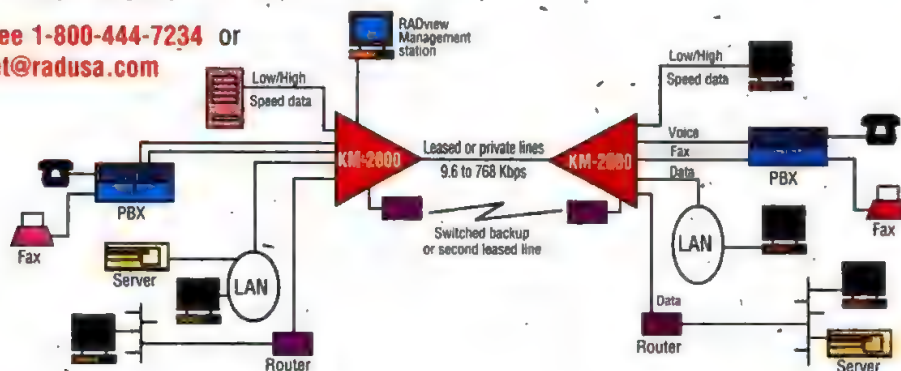


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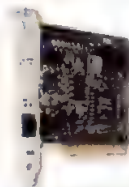
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What Is V.35, and Why Should I Care?

By Les Freed

You've seen plenty of references to International Telecommunications Union (ITU) V.xr specifications before. V.32bis and V.34, for example, define the modulation schemes used for high-speed modems.

So what is V.35? Well, it began life in the early 1980s as a specification for an interface between a network access device (such as a multiplexer) and a high-speed packet data network. V.35 was originally designed to connect a group of modems to a single communications device. The group of modems operated in an inverse multiplexer arrangement; that is, the multiplexer combined several 19.2-Kbps modem links to provide one fast link. This arrangement provided digital link-like speeds in areas where only plain old telephone service (POTS) was available.

An appendix to the V.35 specification defined a suggested electrical connection to provide the necessary high-speed serial communications interface between the multiplexer and the network switching equipment.

The V.35 group-modem market never really materialized, but the interface definition looked good to several manufacturers, which adopted it as a high-speed replacement for the ancient RS-232 interface. The specification didn't define a standard connector, but IBM began making V.35-compatible connections that used a large rectangular connector with huge hold-down screws.

It's a solid connection: the connectors cannot connect the wrong way, and the large screws insure that once installed, the plug won't pull out. If you were to trip over a V.35 cable, you might pull the attached equipment off the table, but you won't pull the plug out. Other vendors, needing "plug compatibility" with IBM communications equipment, followed suit.

The ITU itself abandoned V.35 in 1988, stating, "It is the opinion of the ITU that the information contained in Recommendation V.35 is out of date." That may be true, but until someone invents something better, the V.35 serial interface lives on.

scored just over 98 Kbps—nearly twice the speed of the 56-Kbps link.

In addition, the fax test didn't slow things down as much as we expected. At first we thought this was a flaw in our test procedure, but a Micom representative says that the NetRunner I-Router watches for fax traffic on the voice ports and demodulates the V.29 fax/modem tones, converting them back to data. This data is compressed and sent over the link, where it is converted back to V.29 fax/modem tones. Because fax data is highly compressible, a fax transmission uses very little of the link's bandwidth.

The NetRunner I-Router provided excellent audio quality with a barely noticeable delay in back-and-forth conversation. We set the NetRunner I-Router to use the highest available voice-sampling rate in order to provide the best voice quality. With sampling set at 16 Kbps, our voice-channel torture test used 24.7 Kbps of bandwidth. Normal real-world conversations would use less than half this amount, and you can further reduce voice bandwidth demands by using a lower sampling rate.

The NetRunner I-Router was also designed to keep network managers happy: It supports remote management with any SNMP-based software. The NetRunner I-Router's operating software is stored in flash ROM and can be updated remotely. Moreover, the IPX router is Novell-certified, so rest assured that it will work with future releases of NetWare. All in all, it's a great solution.

NetRunner 75E Integration Router. List price (varies with configuration): Basic unit, \$2,450; two-port analog voice card, \$1,800. Micom Communications Corp., Simi Valley, CA 93063; 800-642-6687, 805-642-6687; <http://www.micom.com>. *Circle 954 on reader service card.*

Pacific Communication Sciences Inc.

Access Plus 100 Integrated Access Multiplexor, Access Plus 200 Integrated Access Multiplexor

Although Pacific Communication Sciences Inc. (PCSI) is a relative newcomer to the multiplexer business, you'd never know it from its Clarity Series multiplexer product family. The Access Plus line, for example, is especially impressive in voice transfer. If your needs call for lots of voice traffic with minimal data or LAN traffic, an Access Plus unit may be the multiplexer for you. If you're looking for a LAN bridge with voice capability as a bonus, you'll probably be happier with the Micom or Data Race product.

PCSI is a division of Cirrus Logic, a company well known for its component-level video chip sets. For our review, PCSI submitted two units: the \$2,750 Access Plus 100 Integrated Access Multiplexor and the \$4,250 Access Plus 200 Integrated Access

Multiplexor. The Access Plus 100 is designed to be a remote-office multiplexer; it supports voice, data, and LAN traffic over a single communications link. The Access Plus 200 is the main-office counterpart of the Access Plus 100, and it supports up to four remote offices connected via four separate communications links.

Our test units were each equipped with two \$1,595 analog voice/fax cards, providing two telephone-line connections from a main office to a branch office in our test network. Each Access Plus unit can contain as many as eight voice cards—the most of any unit we tested.

Voice quality was outstanding, with very little delay, echo, or distortion. The voice cards utilize the CCITT Low-Delay Code Excited Linear Prediction (LD-CELP) voice compression standard. CELP was developed at Bell Labs to provide very high-quality voice-to-data compression with minimal processing delay. The LD-CELP technology proved itself on our torture test. The PCSI unit used only 10.2 Kbps of bandwidth, compared with 24.7 Kbps for the Micom NetRunner I-Router.

Neither Access Plus model includes a dedicated Ethernet port, but each does support multiple high-speed serial ports. To connect two LANs, you'll need an Ethernet bridge or router to convert Ethernet packets into serial data. For our tests, we connected the Access Plus units to our test LANs through Cisco routers at each end of the link. The connection between the multiplexers and routers

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Squeezing Out Every Last Drop of Bandwidth

By Les Freed

It may not seem possible to put LAN, voice, and fax traffic all on a single 56-Kbps link. After all, Ethernet LANs already run at 10 Mbps, and 100-Mbps LANs are becoming commonplace. So how is it possible that these devices can run Ethernet LAN traffic—plus other stuff—over a relatively slow link?

The three solutions we reviewed use a variety of multiplexing techniques to squeeze maximum throughput from a relatively low-speed digital communications link. In addition, they use sophisticated data compression techniques to reduce the amount of data transmitted. Here's a quick overview of the technologies involved.

A multiplexer, or *mux*, is a device that combines several signals into one for transmission over a communications circuit. Muxes are typically used in pairs to provide point-to-point communications, but some muxes can talk to several other muxes at once. (Imagine a pipeline that can carry water, gasoline, and oil—all at the same time.)

Although we computer types think in terms of digital communications equipment, analog signals can also be multiplexed. With FM stereo signals, the left and right channels are combined (multiplexed) at the radio station, then sent over a common signal. Once inside your radio, the signals are demultiplexed into left and right channels.

Digital-signal multiplexing isn't as new as you might think. Back in the 1960s, faced with increasing demands and limited cable capacities, AT&T pioneered the use of digital multiplexing techniques. Many of the techniques devised at AT&T's Bell Labs are still in use today. One of those techniques is *time-division multiplexing*, or TDM.

TDM provides a way to transmit several digital-data and digitized-voice signals over one comm link. TDM works by dividing the available communications bandwidth into equal-size channels, then giving each signal an equal chunk of time on the comm link. On a 56-Kbps line, for example, you could have three 16-Kbps channels.

The problem with TDM is that each signal occupies its channel for the entire time assigned, even when it has no traffic to carry. If one channel suddenly has a large amount of traffic to carry, it can't make use of the bandwidth on allocated yet unused channels. On the plus side, TDM is relatively simple to implement, and TDM multiplexers are generally less expensive.

Perhaps the best way to increase the efficiency of a communications link is to reduce the amount of traffic on the link.

Another technique, *statistical packet multiplexing* (SPM), improves on TDM by allowing idle bandwidth to be recovered and allocated to busy channels. This increases the bandwidth available to any one channel up to the maximum link bandwidth, and increases the overall efficiency of the comm link. SPM, however, brings problems of its own—specifically, the introduction of a time delay into each channel of the transmitted signal. The time delay is not constant; it depends on the amount of data being sent on the other active channels.

For example, if one channel momentarily grabs all the available bandwidth, data on the other channels must wait until some link bandwidth becomes available. Digitized-voice traffic can tolerate some delay, but the delay must be constant in order for the link to sound natural. Because of the unpredictability of the delay time, SPM is not a good choice for voice networking. A similar technique called *fast-packet multiplexing* (FPM) improves on SPM by reducing the amount of time delay involved, but it still does not improve the consistency of the delay.

NEW CHAMPIONS ON THE SCENE

Another multiplexing technique, *asynchronous transfer mode* (ATM), has become very popular in the past two years. ATM breaks data into fixed-length packets, or *cells*. ATM provides high efficiency with little propagation delay. But ATM was designed with extremely high-speed links (T1 and faster) in mind. Micom actually uses a scaled-down version of ATM, called Microband ATM, in its NetRunner I-Router.

Perhaps the best way to increase the efficiency of a comm link is to reduce the amount of traffic on the link itself. Multiplexers can use a variety of data compression techniques to reduce the size of the data stream before it is sent to a remote mux. Unlike file or disk compression programs, multiplexers must compress data on the fly.

Stac, which makes the disk compression program Stacker, also makes a hardware data compression chip that is used by many multiplex manufacturers. The Stac chip can provide up to 4:1 compression on binary data streams.

Link efficiency can also be improved by simply removing unnecessary data from the data stream. Obviously, you can't use this technique with LAN or serial data, but much of a digitized-voice call is useless data. Multiplexers use a technique called *silence suppression* to watch for periods of silence and reclaim the bandwidth they would normally use.

was made via a V.35 high-speed serial connection.

Both the Access Plus 100 and the Access Plus 200 use a combination of TDM and fast-packet switching techniques. Each one also uses dynamic bandwidth allocation, which minimizes the bandwidths used by idle voice and data channels. Still, these products, which finished in last place on

our performance tests, provided less than half the throughput of the NetRunner I-Router.

PCSI's marketing materials stress the voice capabilities of the Access Plus line, and that is definitely its strong suit. With the ability to pass eight conversations over a single 56-Kbps link, an Access Plus 100 or 200 could pay for itself in a year or less.

Analyze your needs carefully; this could be the multiplexer for you.

Access Plus 100 Integrated Access Multiplexor. List price: \$2,750. **Access Plus 200 Integrated Access Multiplexor.** List price: \$4,250. Pacific Communication Sciences Inc., San Diego, CA; 800-933-7274, 619-535-9500; <http://www.pcsi.com>. Circle 955 on reader service card.

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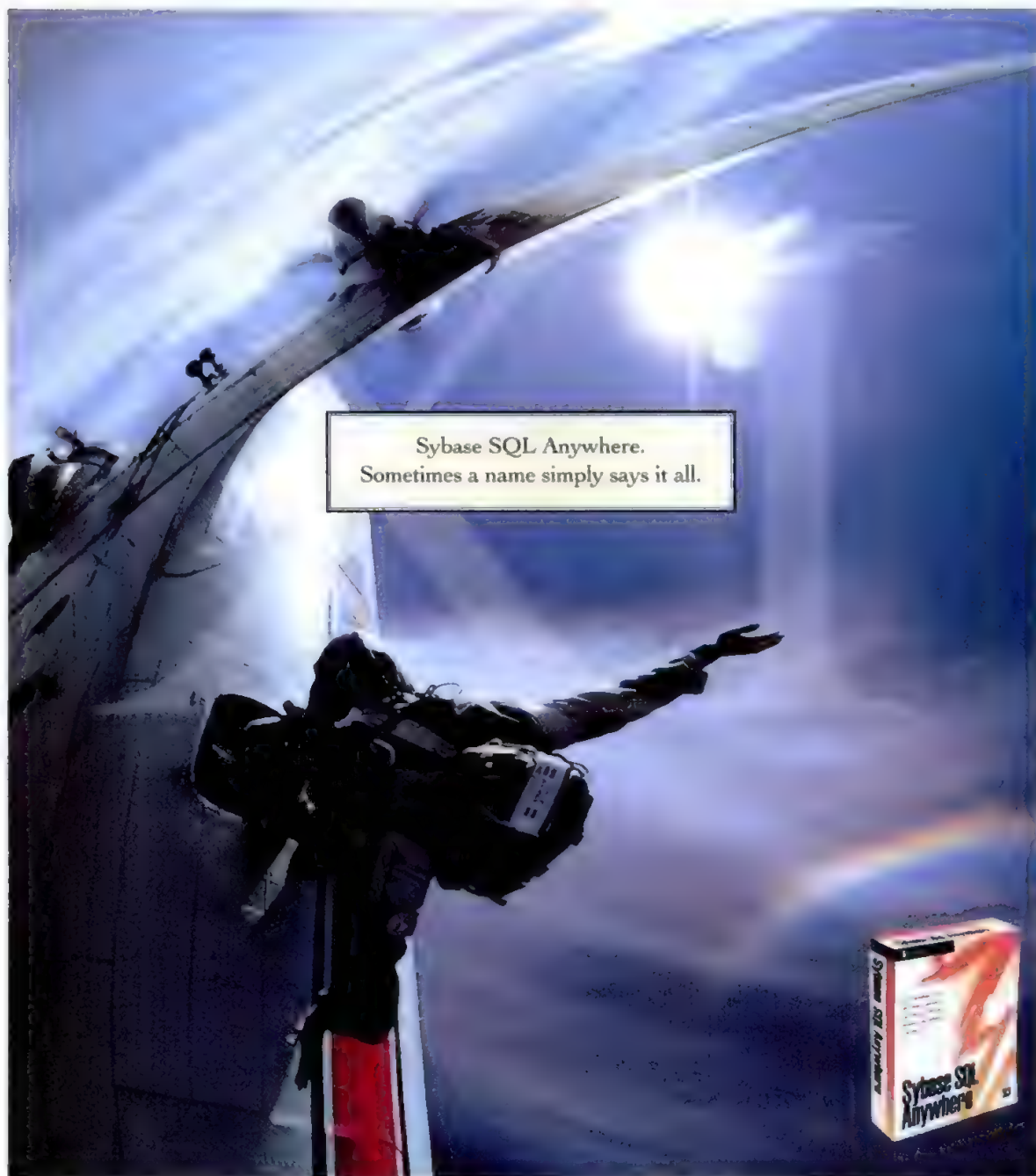
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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

REMOTE-ACCESS SERVERS

A New Remote-Access Tribe

By Charles Lin

A subtle shift in server management may be occurring with the release of two new remote-access servers from Tribe Computer Works, a company primarily geared at the

NetWare, IPX has gained wide acceptance; both Windows NT and Windows 95 have native IPX support. Burst-mode IPX, such as Novell's VLM 1.2 shell, will also allow much faster remote file transfers. At this time,

CONNECT-A-TRIBE: Tribe's new remote-access servers offer a new management language—HTML.



Macintosh. The TribeLink2 (\$1,295) and TribeLink8 (\$1,995) each have a unique feature: HTML-based server management. Tribe is the first company to explore using HTML instead of SNMP for management of remote-access servers.

Tribe's approach has a couple of distinct advantages. First, HTML is undeniably user-friendly. And second, if either version of the TribeLink is connected to the Internet, you can manage it from almost anywhere via a local Internet provider. Another bonus: You can use your favorite Web browser to do so.

One major drawback of the Tribelink is the lack of IPX protocol support. This is a problem because IPX has been the protocol of choice for both large and small businesses. First used by

Tribe does not have any plans to add IPX support.

Tribe is primarily targeting its servers at small companies. The TribeLink will allow small companies to provide remote access without requiring a network administrator. And unlike other remote-access products on the market, it does not require a suite of management utilities on an administrative station.

Another selling point is that small sites can use their IP services remotely via the TribeLink. If the TribeLink is combined with an ISDN Internet provider, any small business can offer high-speed Internet access to clients on the LAN and to users dialing in from home. (Unfortunately, the TribeLink8 can support only one B-channel.)

Each strain of TribeLink supports only TCP/IP and

AppleTalk protocols over dial-in PPP (Point-to-Point Protocol); neither one supports the IPX protocol. AppleTalk and TCP/IP can be used simultaneously, however. The TribeLink also supports CHAP and PAP for user authentication in PPP.

Each server also uses WebManage, the HTML management software, which is stored, along with the HTML management documents, on Flash

ROM inside the TribeLink and can be upgraded with HTTP-blast. The WebManage software can also be accessed from any client PC. The TribeLink has excellent documentation. It will teach you the basics of TCP/IP, so you can quickly get the server up and running.

We looked at both the TribeLink2 and the TribeLink8 and, surprisingly, found that they

Continues on page NE22

REMOTE CONTROL

Framing Network Options

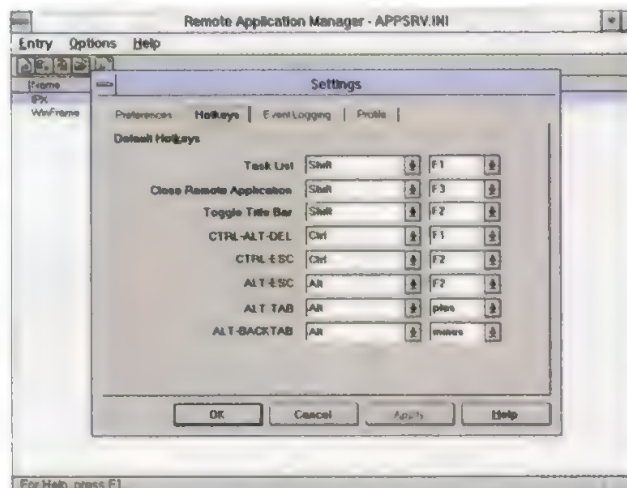
By Steve Rigney

Imagine a supercharged remote-control channel changer that in addition to letting you flip around on your television can turn on your microwave, set your clock, and vacuum. Now you understand the paradigm for Citrix Systems' WinFrame for Networks 1.5. WinFrame is the first program that lets you remotely control a Microsoft Windows NT server, but it offers much more: remote-node connections, direct network connec-

tions over most network protocols (IPX, NetBIOS, and TCP/IP), powerful security, and centralized management.

Basically, WinFrame is a Windows NT Server 3.51 with added communications extensions and protocols. It is also the first remote-access server that lets you run resource-hungry 32-bit Windows NT and Windows 95 applications on a PC that can't even run Windows.

WinFrame retails for \$5,995
Continues on page NE26



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First Looks

Tribe

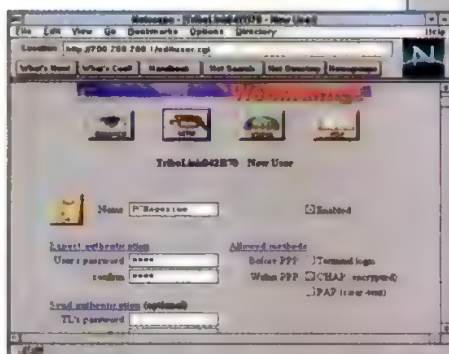
Continued from page NE17

have very different features. Powered by a Motorola 68340 processor, the TribeLink8 has eight Mini-DIN8 serial ports, which require a Mini-DIN8-to-DB-25 adapter for most modems, an AUI port for Ethernet connectivity, and a proprietary console port. We were disappointed with the 57.6-Kbps serial ports on the TribeLink8, primarily because they can support only a single B-channel of ISDN. The TribeLink2 offers two RS-232 ports with 115.2-Kbps throughput, both AUI and RJ-45 Ethernet connectors, and a familiar DB9 console port for first-time configuration.

After assembling the Ethernet transceiver, console adapter, and Mini-DIN8 cables, we were able to set up the TribeLink8 without difficulty. A single command configures the TribeLink's IP address through the Windows terminal emulator. The rest of the configuration can be done using any Web browser, such as Netscape Navigator 1.1, which is included in the package. (The setup of the

ization strings from the table.

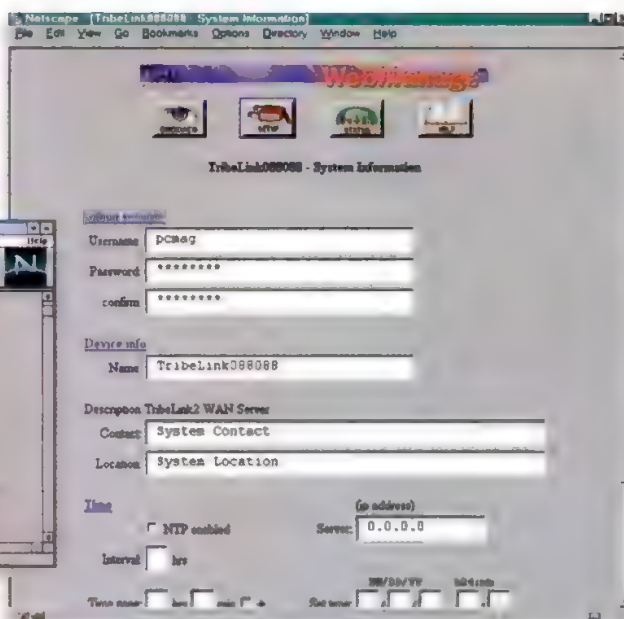
The TribeLink lets you assign an IP address to each port, so remote users don't take up precious network numbers. Static routing information can be entered, and RIP (Routing Infor-



mation Protocol) send and receive options are available also.

If you have a Macintosh, Tribe's LinkTracker can configure IP addresses for the TribeLink via AppleTalk. Without it, a special console port connector available from Tribe will allow you to set IP addresses using a terminal emulator.

For remote routers, the TribeLink can dial into router accounts and execute an optional log-on script to supply user names and passwords. The TribeLink can obtain its time information from a Network



SURF SUPPORT: The TribeLink's configuration screens will look familiar to those used to HTML-based Web pages.

with an idle time-out. The administrator can also set cumulative usage to limit a user's daily, weekly, or monthly access. And accounting reports can be generated to show individual usage.

The servers have limits, though. The TribeLink2 stores only up to 200 users in its database, and the TribeLink8 stores only up to 400. You can use a RADIUS (remote authentication of dial-in users) server in-

the built-in Dial-Up Networking. Windows 3.1 users will require third-party PPP client software such as NetManage Chameleon. Tribe Computer Works provides TribePPP for remote connection for Macintosh. The company, however, neither provides a software solution for the PC nor has any immediate plans to do so.

With their innovative management platform, the TribeLink units could be top contenders in the remote-access market, if it weren't for the lack of IPX-protocol support and full 115.2-Kbps DTE (data terminal equipment) speeds. If you don't need IPX support, or if you're in a Macintosh shop, the TribeLink is definitely a good investment and a relative bargain. We still conclude, however, that Tribe could have taken the best from the TribeLink2 and TribeLink8 to make one really outstanding remote-access server. **TribeLink2.** List price: \$1,295. **TribeLink8.** List price: \$1,995. Tribe Computer Works Inc., Alameda, CA; 800-778-7423, 510-814-3900; fax, 510-814-3980; <http://www.tribe.com>; sales@tribe.com. Circle 951 on reader service card.



BUTTON UP: The TribeLink's user-friendly buttons are a switch from the usual cryptic management interface.

TribeLink2 was quite easy, as it is basically plug-and-play.)

Managing the TribeLink2 and TribeLink8 with a Web browser was pure pleasure. WebManager can store a table of modem strings, and it will let you configure each serial port with modem-speed and initial-

Time Protocol (NTP) server if you have one on your network, or if you are connected to the Internet. The TribeLink also has a diagnostic log that can be accessed for troubleshooting.

User management is one of the TribeLink's strengths. Each PPP session can be time-limited

stead to support an unlimited number of users. RADIUS is Unix-based server software for managing multiple remote-access user databases. It can keep permanent user records and accounting information.

If you have Windows 95 on your remote PC, you can enjoy

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switching. When we eat dinner, we
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take customers to lunch, we talk about
switching. When we talk
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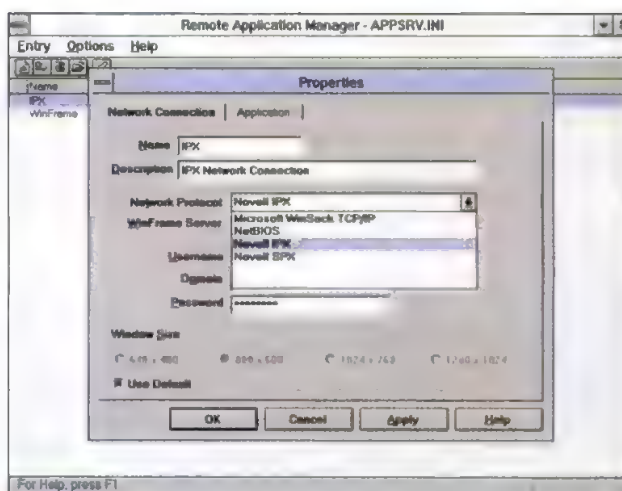
Continued from page NE17

The price is relative, however. Buying a powerful server and WinFrame is probably less expensive than replacing 60 old 386SX PCs with 486- or Pentium-based PCs capable of running Windows NT.

and a Digiboard four-port I/O adapter and established a direct network connection with three Compaq Deskpro 386N's, each running DOS and equipped with a 386 processor and 4MB of RAM. If you have ever installed Windows NT, you shouldn't encounter any problems installing WinFrame. In case you do, though, WinFrame comes with volumes of manuals.

We were impressed when we were able to run the 32-bit version of Microsoft Office 95 on these DOS-based PCs. In fact, the remote version of Windows NT ran faster on these PCs than Windows 3.x installed directly. We also established remote-node and remote-control connections from several PCs running Windows for Workgroups, Windows 95, and Windows NT.

The only problem we encoun-



tered was with the network address of our WinFrame server and how it was broadcast on the network. Windows 3.x and DOS

clients could automatically determine the name of the Win-Frame server on the network, but we had to provide the node

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and network address of the WinFrame server before connecting from Windows 95 and Windows NT across the network. The folks at Citrix are aware of this and are working on a solution.

WinFrame also offers simultaneous remote-node and remote-control connections for PCs running DOS, Windows 3.x, Windows 95, and Windows NT. But it offers only direct dial-up remote control for DOS-based PCs. To establish a dial-up remote-control session running any version of Windows, you first must establish a remote-node connection using Windows NT's built-in remote-access client or some other product, such as Shiva's LANRover.

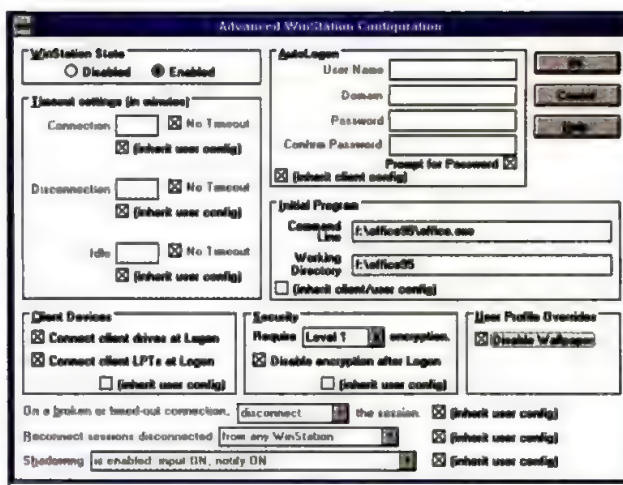
A remote-control connection over a remote node usually means more network traffic on the phone line and less performance. But a 1MB file trans-

fer using WinFrame's remote control over a remote node and Symantec's pcAnywhere for Windows was 4 seconds faster. The developers at Citrix are working on a dial-up remote-control connection for all versions of Windows.

You can monitor other users' remote sessions using a feature WinFrame calls *shadowing*. If you have security rights, you can take control of any remote session and even move your mouse and type on another user's screen.

Unfortunately, WinFrame doesn't have a chat feature, and you can't monitor sessions from the server's console, only from another remote client.

If not all of your PCs can run Windows and you need to deploy 16- and 32-bit applications, WinFrame is currently the best solution (it's the only 32-bit one).



CONNECT A LOT: The WinStation Configuration utility allows you to set up multiple asynchronous connections over different network protocols.

The cost may seem steep, but compared with replacing existing PCs, it's not unreasonable. **WinFrame for Networks 1.5.** List price: For 15 concurrent users,

\$5,995. Citrix Systems Inc., Coral Springs, FL 33071; 305-755-0559; fax, 305-341-6880; <http://www.citrix.com>. Circle 952 on reader service card.

MULTIPLE ACCESS By Frank J. Derfler, Jr.

Plan for Opportunity



If you like today's competition among long-distance telephone companies, then you'll love the near future: Everything is busting loose. Local dial-tone service, once a sacred monopoly, is coming up for grabs in many cities. Long-distance carriers, such as AT&T,

MCI, Sprint, and Wiltel, will be able to offer you a full line of services. They want to play in the high-margin, high-cash-flow local dial-tone market. Surf over to <http://www.wiltel.com/atlas/network.html> for a cool map showing Wiltel's reach.

And the local telephone companies will be able to offer long-distance services. The locals think they can offer certain services, such as regional frame relay, at better prices than you'll get from the long-distance vendors while keeping a little more margin for themselves.

A third tier of companies—special service providers such as MFS Communications (www.mfsdatanet.com), Brooks Fiber, IntelCom Group, Intermedia, Teleport, and Worldcom—also could make impressive gains in the local dial-tone market. Today, these companies carry corporate data around and between major cities. They just need permission to offer dial-tone service to smaller urban areas.



What difference does this make to you today and tomorrow?

Well, these changes in connection services drive how you should physically configure your network today. In telco-speak, the *main distribution frame*, or MDF, is the place where your outside lines come inside—where the WAN meets the LAN. Usually the domain of the telephone person, the MDF is going to become a big deal to you network planners as you choose among digital dial tone, remote access, frame relay, and long-distance service providers.

This year you might change the carrier you use to link your routers as often as you change your furnace filters. There is no harm in going for the best prices on a quarterly basis. You might change local dial-tone or ISDN providers as often as you wash the office windows. Companies such as AT&T and MCI offer specialized services for your remote-access, Lotus Notes, and NetWare needs. You might want to try some outsourced LAN services, such as AT&T's NetWare Connect.

Many service providers will lease existing local cables to reach you, but others will bring in their own drops from urban fiber-optic cable or wireless backbones. You'll need to find or create a secure area—equipped with plenty of power outlets and access to other parts of the building and to an outside wall—to house the central termination point for the incoming circuits. And the MDF room should be separate from the server room we described in the Network Edition of January 9, 1996.

Your LAN-to-outside-world interface is a big deal and you'd better provide for it. If you don't, you *will* be sorry.

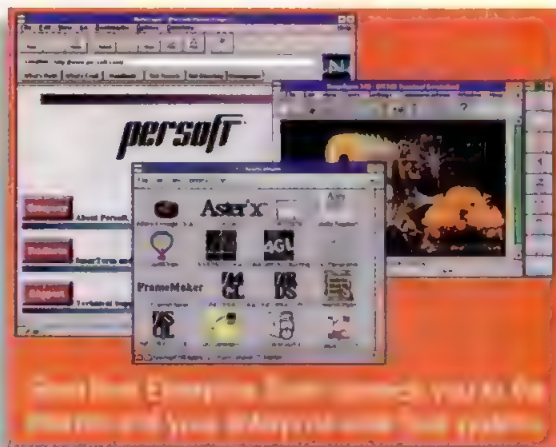
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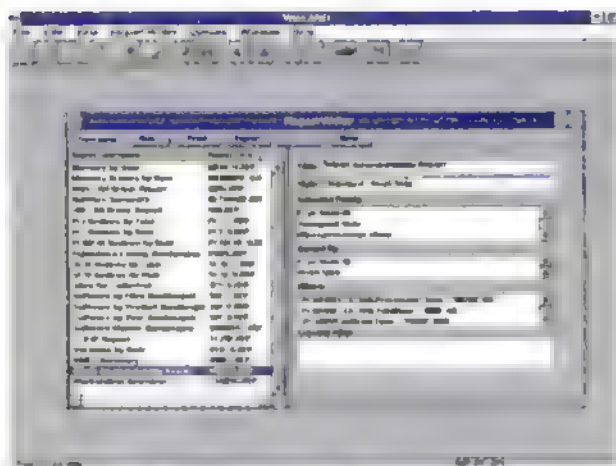


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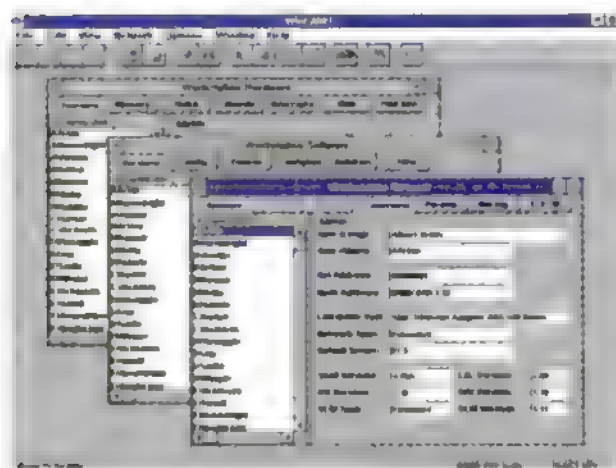
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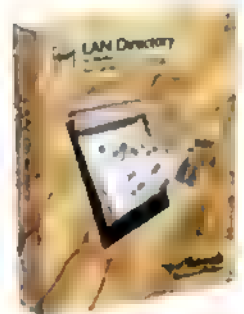
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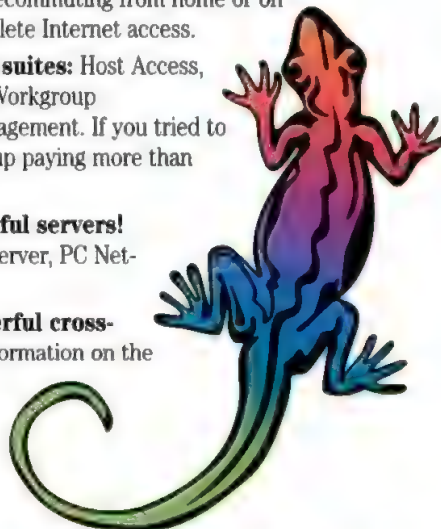
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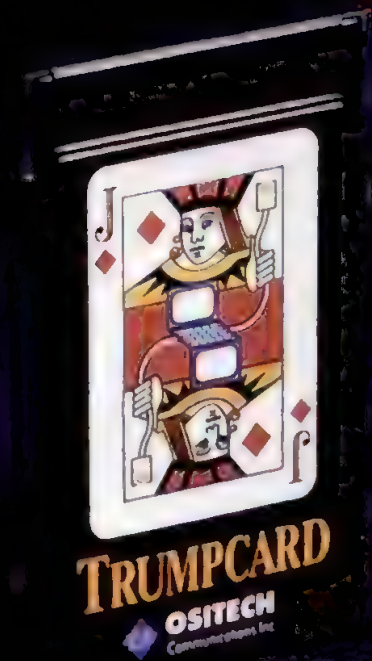


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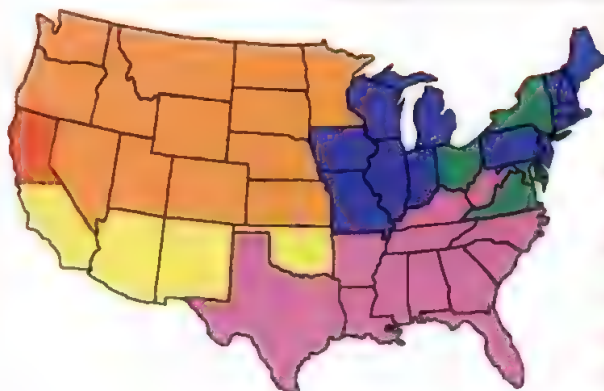
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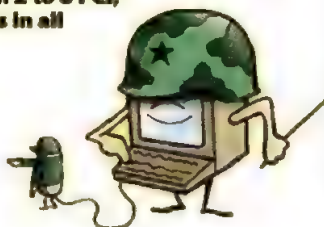
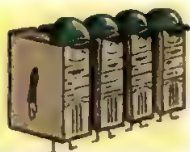
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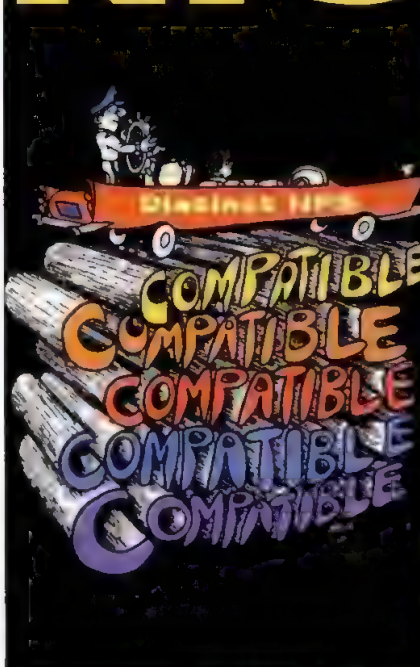
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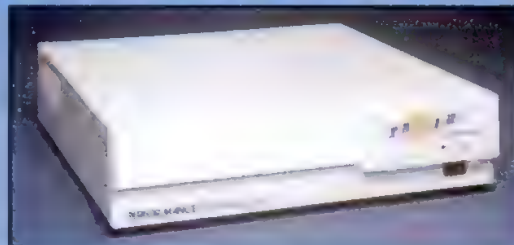
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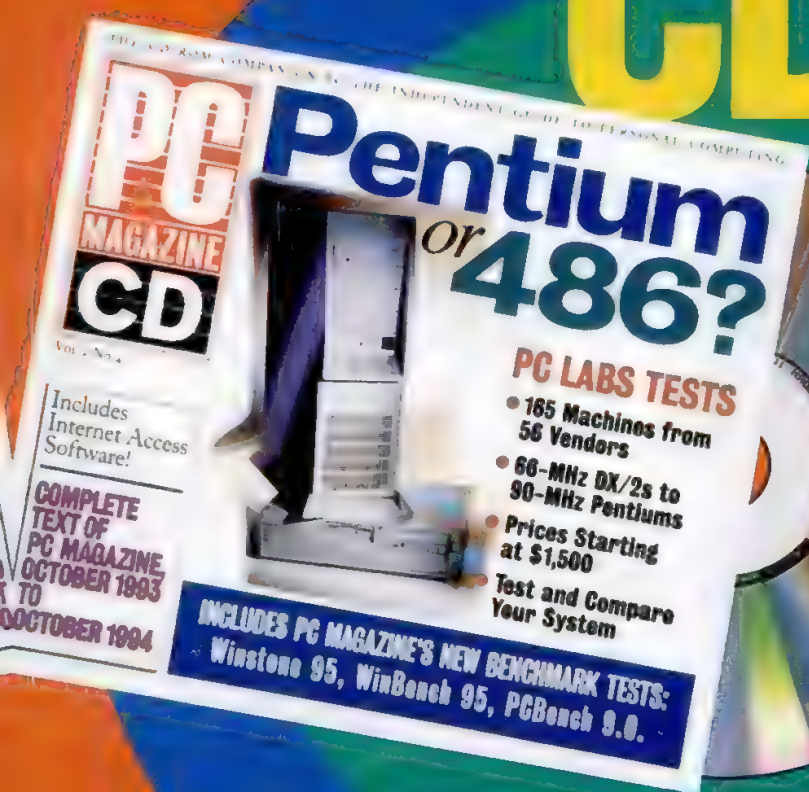
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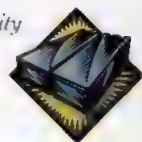
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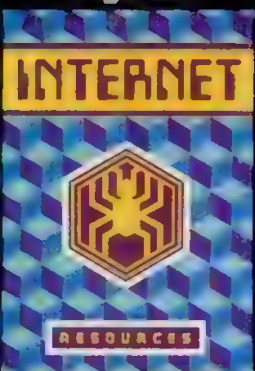
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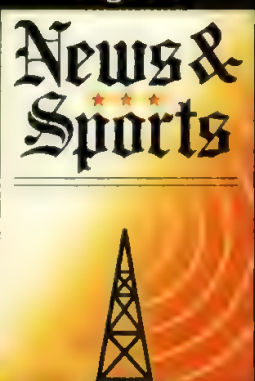
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News & Sports

AFTER HOURS

THE 10

WEB

By Cade Metz

With its intercontinental span and rich, varied communication tools, the Internet's World-Wide Web marks the most significant mass-media revolution since the invention of television. This enormous network of hyperlinked sites lets any organization or individual instantaneously serve up information to a global audience. Freedom of expression on this scale has led to more than its share of frivolity, but it has also spawned huge numbers of innovative, intriguing, and invaluable sites that are instantly accessible from any PC on the Web.

TOP 100 LOGO BY JACK HARRIS/VISUAL LOGIC

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REFEREN

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magazines

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TOP

&
CAREERS

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EDUCATION

To help you tap into these riches, dozens of *PC Magazine* editors and Labs technicians examined thousands of home pages in search of the Web's 100 most informative and technically adept sites. Our final choices are divided into ten categories: Computer Resources, Internet Resources, Commerce and Marketing, News and Sports, Government, Reference, Education and Careers, E-Zines and On-Line Magazines, Art and Music, and After Hours. We've even supplemented these sites with a list of Web catalogs and a brief guide to obtaining your own connection. So turn off your TV and explore the next communication frontier.

ICON ART BY DANIEL PELAVIN

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AFTER HOURS

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With the advent of the World-Wide Web, the personal-computer industry finally has an information medium that can keep up with its dizzying rate of change. Instead of being kept on hold by a technical-support operator or making the trek down to the local Egghead Software store, you can simply launch your browser and instantly

research the latest in hardware and software. If you fear that you may buckle under the weight of the latest stackable hub discussion, however, take heart. Many of these top PC-industry sites also offer some of the Web's slickest graphics and sharpest layouts to keep you going.



Apple Since August 24, Apple's inpeccable home page has become the main source for anti-Windows 95 sentiment. Amidst stately art, a well-organized hierarchy of links, and considerable product information, Apple continues to reiterate a common theme: that most of Windows 95's features were introduced by the Macintosh back in 1984. Of course, the site also details advances made during the intervening 11 years, including the Apple multimedia program and the latest PowerBook incarnations.

<http://www.apple.com>

Compaq Despite a lead graphic that resembles an ancient Roman bath, Compaq's site is rich in coverage of modern technology. Its discussions of desktops, notebooks, operating-system strategies,

and support options are easily accessible via a categorized search tool and a carefully arranged table of contents. As in most other major computing sites, Compaq has also jumped on the bandwidth wagon and added a page dedicated to Windows 95.

<http://www.compaq.com>

Digital The product updates, periodicals, and reading rooms that crowd Digital's home page make it one of the Web's prime sources for technical research. Don't leap in, however, without the on-line salutation from CEO Bob Palmer.



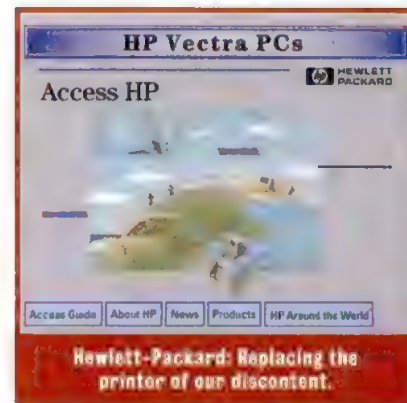
Our Web Site Reviewers: DON WILLMOTT is an executive editor of *PC Magazine*. SHARON TERDEMAN is a senior associate editor of *PC Magazine*. ANGELA HICKMAN, ELLYN MCCASLAND, CADE METZ, and MICHAEL MUCHMORE are staff editors of *PC Magazine*. EYAL RABINOVITCH is an editorial researcher at *PC Magazine*. DEVAL SHAH is technical analyst at PC Magazine Labs. TOM GIEBEL is a technical associate for PC Magazine Online. THOMAS MACE was the senior editor in charge of the story, and JAY MUNRO was the project leader.

In a dapper double-breasted suit, Mr. Palmer offers a greeting that will put a smile on your face and a lift in your mouse click as you search this broad collection of computing information and services. The art is attractive but unobtrusive, and a powerful browse engine allows for easy navigation.

<http://www.digital.com>

Hewlett-Packard Hewlett-Packard's lead art—which includes two people setting up a print server that spans several continents—is one of the most engaging graphics in the computing genre. The rest of the site is equally attractive, with its extensive suite of navigation tools (search engine, table of contents, index, and browsing tutorial), international resources, product guides, and news. HP's chemistry and bioscience site even lets you bone up on supercritical fluid extractors before picking out a high-end scanner.

<http://www.hp.com>



IBM IBM's Web site has a little of everything. To satisfy those curmudgeons who keep an emergency copy of OS/2 in the glove compartment, there are discussions of everything from ATM strategies to PowerPCs, Token-Ring cards, and AS/400 systems. The site also contains a slew of more eclectic pages sure to appease the Generation Xer who hasn't picked up a book since the introduction of Atari: sports pages, children's sites, art, poetry, games, fractals, and TV commercials.

<http://www.ibm.com>

Intel The Intel Web site doesn't lower itself to the level of the average Joe; its

white papers and developer support documents offer detailed information that will please even prodigies who construct PCs from discarded appliances. Although you may be mesmerized by discussions of the Pentium Pro and the company's foray into networking, don't pass up the Uniquely Intel Shop, which offers Intel polo shirts, holiday ornaments, and cuff links. As you delve into embedded design, visions of \$3.25 lucite key chains will surely drift before your eyes.

<http://www.intel.com>

Microsoft The Microsoft juggernaut has its hands in everything, and the Web is no exception. This software-centric site offers everything your favorite computer junkie could possibly desire: technical-support libraries, a forum for developers, product summaries, news, research, and freeware (including the latest beta of Microsoft's fledgling Web browser: Internet Explorer 2.0). Perks such as in-depth Windows 95 coverage, brand-new search tools, and Microsoft Library access are compelling, but it will be the Bill Gates keynote speeches that put this site on your bookmark list.

<http://www.microsoft.com>

NeXT Since NeXT's recent \$8 million deal with Merrill Lynch, a bitmap of the latter's bovine mascot has dominated this home page, but its true focus is the latest in object-oriented programming. Coverage of the NeXTStep operating system, the OpenStep object layer, the WebObjects development environment, news releases, and technical support is supplemented by some of the most aesthetically pleasing designs around. CNN junkies can even view an object-oriented installment of Moneyline.

<http://www.next.com>

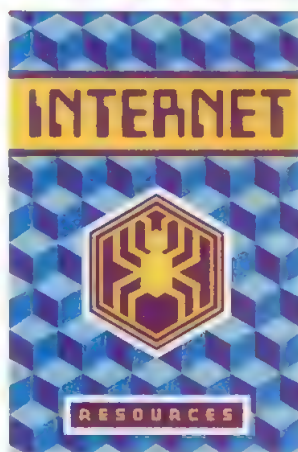
Novell The Novell home page is for those who peruse technical manuals in place of the morning paper and have wiring closets in their bedrooms. You can browse complete documentation for NetWare, UnixWare, GroupWise, or ManageWise, feed your appetite for network trade shows, or use a nationwide technical support locator. And now that the NetWare 4.1 manual has been translated into Portuguese, foreign linguistics has finally met file and print sharing.

<http://www.novell.com>



ZD Net If Napoleon can crown himself emperor, we can certainly nominate our own Web site to our list of the top 100. ZD Net offers on-line access to Ziff-Davis's broad range of publications, a collection that we believe is unmatched in the world of cutting-edge computer news and reviews. It links to sites representing each Ziff-Davis periodical—including *PC Magazine*, *Computer Shopper*, *Family PC*, *MacUser*, *MacWEEK*, *PC Week*, and *ZD Internet Life*—plus several advertisers and an invaluable Trailblazer site that provides a thorough tour of computing on the Web.

<http://www.zdnet.com>



The World-Wide Web is a recursive medium; most of the tools and information needed to browse the Web can be found by browsing the Web. As soon as new standards or applications are remotely finished, they are immediately and publicly available for inspection. Such a trend allows you to sample the initial beta version of the

latest Web tool long before it hits the shelves at the mall (it can also subject you to system crashes each time you click on its launch icon). Although some products aren't yet ripe and some standards aren't finalized, the following sites offer precious content for keeping Internet users up to speed.

BrowserWatch Netscape Navigator may seem like the only browser on the planet, but even the '27 Yankees had competition. Browser watcher Dave J. Garaffa and his BrowserWatch Web site keep a comprehensive list of browsers for all major platforms, links to the sites where those browsers are housed, and a news section of late-breaking browser developments. You can even study the activities of your favorite browsers by delving into an extensive cache of browser statistics. Browse and browse some more.

<http://www.ski.mskcc.org/browserwatch/>

Java Sun's new programming language, Java, has very little to do with your morning cup of coffee, but it will change the way you perceive the Web. It lets developers create sites that contain embedded, machine-independent applications and paves the way for a truly interactive Internet. Using a Java-enabled browser (Sun's Hot Java or Netscape Navigator 2.0) to access the Sun home page (<http://www.sun.com>)



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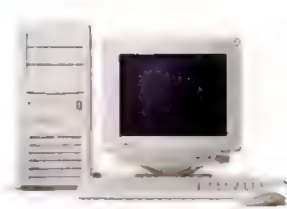
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Processor	Pentium 75MHz	Pentium 120MHz	Pentium 100MHz	Pentium 133MHz
Std./Max. Memory	8MB/136MB	8MB/136MB	16MB/192MB	16MB/192MB
Hard Drive	630MB or 1GB	630MB or 1GB	630MB or 1GB	1GB
Cache Internal	16KB	16KB	16KB	16KB
Cache External	256KB (optional)	256KB (optional)	256KB	256KB
Architecture	PCI	PCI	TriFlex/PCI	TriFlex/PCI
Video Memory/Max.	1MB/2MB	1MB/2MB	1MB/2MB	1MB/2MB
Compaq 150 Color Monitor	Yes	Yes	Yes	Yes
Diskette Drive	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB
Expansion Slots (Total)	3	3	4	5
Drive Bays (Total)	3	3	4	5
Ports: Serial/Parallel	1/1 (ECP)	1/1 (ECP)	1/1 (ECP)	1/1 (ECP)
Security Features	Yes	Yes	Yes	Yes
Processor Upgradable	Yes	Yes	Yes	Yes
101-Key Keyboard, Mouse	Yes	Yes	Yes	Yes
Software Preinstalled (Choice of)	MS-Windows® 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1
Energy Star Compliant	Yes	Yes	Yes	Yes
Limited Warranty*	3-Year	3-Year	3-Year	3-Year
Price†				
630MB Hard Drive	\$1,779	\$2,269	\$2,279	-
1GB Hard Drive	\$1,979	\$2,429	\$2,769	\$3,329

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	Contura 430C	Contura 430CX	LTE 5000 Model 510	LTE 5000 Model 810
Processor	486DX4/100MHz	486DX4/100MHz	Pentium 75MHz	Pentium 75MHz
Std./Max. Memory	8MB/32MB	8MB/32MB	8MB/72MB	8MB/72MB
Hard Drive	720MB	720MB	510MB (removable)	810MB (removable)
Cache	16KB Internal	16KB Internal	256KB, 64-Bit	256KB, 64-Bit
Diskette Drive	Internal 3.5" 1.44MB	Internal 3.5" 1.44MB	Modular 3.5" 1.44MB	Modular 3.5" 1.44MB
Display	10.4" Color Dual Scan	10.4" Color TFT	10.4" Color Dual Scan	10.4" Color TFT
Video Graphics	32-Bit Local Bus	32-Bit Local Bus	32-Bit PCI Local Bus 1MB VRAM	32-Bit PCI Local Bus 1MB VRAM
PCMCIA Slots	2 Type II or 1 Type III	2 Type II or 1 Type III	2 Type II or 1 Type III	2 Type II or 1 Type III
16-Bit Audio	No	No	Yes	Yes
Internal CD-ROM Drive	N/A	N/A	Optional	Optional
Integrated Pointing Device	Optical Trackball	Optical Trackball	EasyPoint™ II	EasyPoint II
NiMH Battery	3-5 Hours	3-5 Hours	2-4 Hours	2-4 Hours
Ports	Keyboard/Pointing Device, Enhanced Parallel, Serial, External SVGA	Keyboard/Pointing Device, Enhanced Parallel, Serial, External SVGA	External Keyboard/Pointing Device, Headphone/Speakers, Microphone, Infrared Communication, External SVGA	External Keyboard/Pointing Device, Headphone/Speakers, Microphone, Infrared Communication, External SVGA
Software	MS-Windows® 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1; MS-Video for Windows, Compaq Sound System	MS-Windows 95 or MS-Windows 3.1; MS-Video for Windows, Compaq Sound System
Dimensions/Weight	11.9"x9"x2.2"/6.25 lbs.	11.9"x9"x2.2"/6.5 lbs.	12.2"x9"x2"/7.1 lbs.	12.2"x9"x2"/7.3 lbs.
Worldwide Limited Warranty*	3-Year	3-Year	3-Year	3-Year
Price†	\$2499	\$3099	\$3999	\$4999
Optional Expansion Base	Includes a battery charger and separate AC adapter. Interfaces include: serial, enhanced parallel, monitor, numeric keypad, keyboard, mouse, and optional Ethernet. Monitor stand included.		Modular expansion base allows devices to be shared between the notebook and base. Supports two additional hard drives or CD-ROM drives and additional diskette drive. Also charges up to 2 batteries.	
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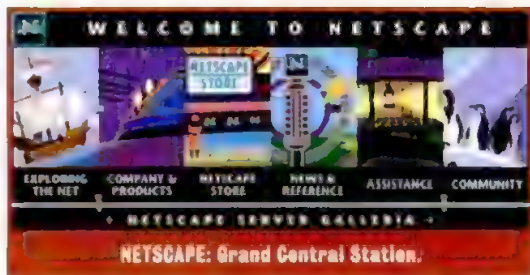
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www.sun.com), which provides unprompted sound, animation, and sprightly icons that dance across your monitor, is the coolest thing since the lava lamp.

<http://java.sun.com>

NCSA From the University of Illinois at Urbana-Champaign, the National Center for Supercomputing Applications offers one of the most venerable and extensive

sites on the Web. It may not have icons that dance virtual jigs and bitmaps of famous CEOs, but it does supply Internet advice, industry publications, multimedia exhibits, and software. Of course, you can give in to nostalgia and retrieve a copy of NCSA Mosaic, the browser that began the Web revolution. Couple it with an excruciatingly slow modem, circa 1993, and you can relive all your old downloads. <http://www.ncsa.uiuc.edu/>

Netscape Trying to download the latest version of Netscape Navigator from the Netscape home page is like waiting for the restroom at a beer fest. While you are waiting, however, your options are limitless. Netscape devotes pages to the Web's newest

and hippest sites, Internet directories, company merchandise, and on-line news. If you ever do acquire the browser, you will command the slickest features on the market. Despite some bugs, Version 2.0 now supports threaded discussion groups, secure e-mail, Windows 95, and Java applets.

<http://home.netscape.com>

PSINet You may have the latest GUI Ping utility and a browser named for a pot of coffee, but you can't get onto the Internet without an access provider. One of the leading national providers is PSI, whose Web site provides access information for both the neophyte and the experienced user. If you still think Gopher is a "Love Boat" character, you should bone up on Pipeline USA, PSI's inexpensive provider, but more seasoned users will require the higher speeds of its Interramp service. <http://www.psi.com>

Still Not Connected?

If you still don't have an Internet connection, our list of the top 100 Web sites loses much of its charm. Luckily, getting onto the Web via modem is simpler than ever before. The major commercial on-line services now offer Internet access as a core feature, and several dedicated Internet access providers have expanded their networks nationwide.

To help you get connected, here is some basic information about the four largest on-line services and four nationwide access providers. If you take the on-line service route, you can order free software for America Online, CompuServe, and Prodigy by phone (if you know someone with Web access, you can also download it from their respective Web pages). Of course, the client for The Microsoft Network ships with Windows 95. Each of these services offers its own browser, but you can substitute a third-party browser if you prefer. For additional information on Internet connections, see "New Paths to the Net" (*PC Magazine*, October 10, 1995), which covers these services and providers as well as several others.

ON-LINE SERVICES

Our recent Editors' Choice winner, **America Online** (800-827-6364, <http://www.aol.com>) offers 28.8-Kbps access speeds, an integrated HTML 2.0 browser, and low pricing (\$9.95 per month for 5 hours, \$2.95 each additional hour). The browser has a categorized hot-list feature and a full suite of navigation tools.

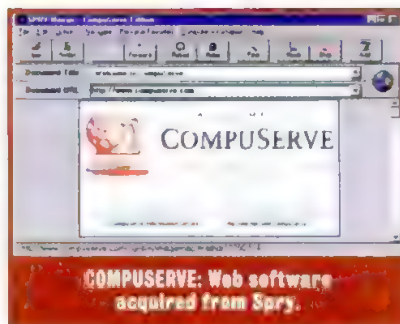
Since acquiring Spry, **CompuServe** (800-848-8199, <http://www.compuserve.com>) delivers full Web access through its proprietary NetLauncher browser, for a reasonable \$24.95 per month for 20 hours and \$1.95 for each additional hour. You will have to launch a separate session when Web browsing, but

NetLauncher has a predefined hot list and helpful status bars.

Internet access via **The Microsoft Network** (800-386-5550, <http://www.msn.com>) and the Internet Explorer is available only to Windows 95 users. Pricing starts at \$19.95 per month

for 20 hours and \$2 for each additional hour. Version 2.0 of the Internet Explorer now supports a host of new HTML extensions and support for VRML content.

Prodigy (800-776-3449, <http://www.prodigy.com>), the first on-line service to offer Web access, lets you choose between its proprietary browser and the popular Netscape Navigator as part of its 30/30 plan (30 hours for \$29.95). Access is mostly limited to 14.4 Kbps, but faster speeds are on the way.



INTERNET ACCESS PROVIDERS

UUNet's **AlterDial** access provider (800-488-6384, <http://www.uunet.net>) is usually coupled with NetManage's Chameleon for Windows software, and it has somewhat high prices (\$25 for setup; \$30 per month for 25 hours and \$2 for each additional hour). Setup of Chameleon is fairly difficult, but its suite of tools is impressive.

You can easily access the **IBM Internet Connection Service** (800-455-5056, <http://www.ibm.com/globalnetwork>) from OS/2 Warp or the IBM Internet Connection for Windows. Pricing is \$29.95 per month for 30 hours and \$2 for each additional hour.

PSI's **Pipeline USA** (800-453-7473, <http://www.psi.net>) supplies access to neophytes for a \$19.95 flat fee per month, while **Interramp** (800-774-0852) targets more experienced users and has higher prices (\$9 per month for 9 hours and \$1.50 each additional hour). Interramp uses Chameleon, and Pipeline has its own software package.

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ATI Conspire 3825plus (33.6K-bps connection)	63.7
Hayes OPTIMA 288 w/4.5I* (28.8K-bps connection)	79.4
	Mbit/s Per sec

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*Tests conducted by industry publication labs. *Reprinted from PC WEEK September 18, 1995. Copyright © 1995 Ziff-Davis Publishing Company. Call Hayes Online: 720-446-6336. Hayes Worldwide Web Site: <http://www.hayes.com> or Internet to "hayes.com". © 1995 Hayes Microcomputer Products, Inc. P.O. Box 195203 Atlanta, GA 30348. Hayes the Hayes icon and the Hayes logo are registered trademarks, and Increasing the Speed of Business, OPTIMA and Century are trademarks of Hayes Microcomputer Products, Inc.

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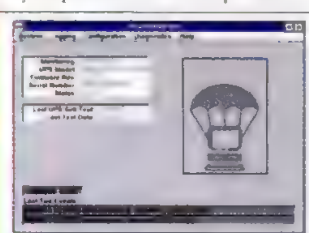
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All in all, you can't make a bad choice when you choose the company that protects more PC's than all other UPS vendors combined: APC.

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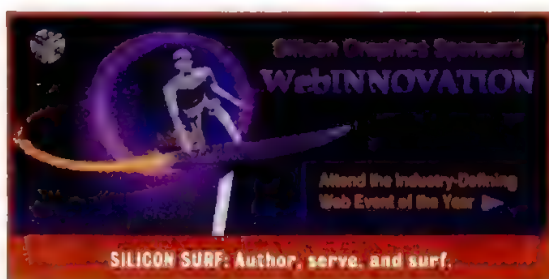
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Silicon Surf A Silicon Graphics home page without eye-catching art would be as unfathomable as a John Grisham novel without a lawyer. In addition to some of the sharpest visuals, this site details some of the finest hardware and software for Web authoring and serving. You can also download a comprehensive collection of Web freeware, including a 3-D viewer, file converter, and http benchmark test that lets you measure the performance of your Internet server. <http://www.sgi.com>

The Ultimate Collection Of Winsock Software and The Consummate Winsock Apps List The only tie in our Top 100 involves two sites that offer exhaustive lists of Winsock-compliant freeware and shareware for a variety of platforms. In both of these directories, each application is accompanied by a description, a review, a rating, and a link to the home page that houses it. Take full advantage of both these sites, fill all your Internet tool needs, and disregard the fact that this pushes our list to 101.

<http://www.tucows.com>
<http://dwsapps.texas.net>

UUNet Technologies If you can't decide whether to use a tiered T-3 link or 56-Kbps frame relay, the UUNet home page is your refuge. This self-proclaimed pioneer of commercial Internet services offers global access from a variety of direct and dial-up connections for both the individual and the business user. UUNet is also one of the best places to be when you finally decide to create your own site. Not only does it supply documentation for HTML and http, it also allows you to post your page on one of its many Web servers. <http://www.uu.net>



The Web Developer's Virtual Library For the serious Web master who dreams in HTML and sends out URLs in place of Christmas cards, there is The Web Developer's Virtual Library. This simple, savvy site offers links to important style guides, technical sites, development tools, and even Web-related job listings. It also features Spectrum, The WDWL Journal, an on-line magazine



wary of sending credit card numbers into cyberspace even though it is no different from using them over the phone or in a restaurant. Such cynics, however, have not browsed our top ten commerce and marketing sites, which hint at the future of shopping and advertising on the Web.

Amazon.com Books The bibliophilic Web surfer may seem like a contradiction in terms, but Amazon.com boasts a greater selection of books than any other store in existence—virtual or tangible. Its inventory of over 1 million titles, which the company equates with the voluminous waters of the Amazon River, is searchable by keyword, author, title, or subject. You can purchase via Netscape's Secure Commerce Server or over the phone, which allows you to read about

devoted to hardware- and software-based Web issues. Whether you are choosing a Web server or examining your use of hypertext, Spectrum is the e-zine to turn to. <http://www.enterprise.net/stars>

World-Wide Web Consortium This hub of on-line activity is a refreshing throwback to the days when the Web was a Swiss novelty instead of a pop culture extravaganza. It still forgoes extensive graphics and elaborate layouts and sticks to informative Internet-related content. Specifications for http, HTML, Internet commerce, addressing, and graphics are readily available, as are Web mailing lists and myriad newsgroups. The site contains more acronyms than a James Bond flick, but it will give you everything you need to know about surfing and authoring on the Web. <http://www.w3.org>

Someday, you may use the Web to purchase a Park Avenue penthouse or gamble away your life savings on a virtual one-armed bandit, but current Internet commerce is still in its infancy. Just as some financial Luddites keep their cash under the mattress rather than in the bank vault, many Internet users continue to be

the infamous hacker Kevin Mitnick without giving him access to your Visa account. <http://www.amazon.com/>

CDNow Should you miss the latest installment of "MTV News" or fail to find your favorite Meat Loaf album at Tower Records, CDNow is your fix. You can choose from over 165,000 CDs in a variety of genres, read up on the latest industry gossip, or delve into the current pop sounds of Africa and the Pacific. Credit



card, check, or money order purchases can be made off-line or on-line, and CDs will be delivered to your doorstep faster than you can say *Madonna*.

<http://cdnow.com>

Fun City Classifieds If you haven't found a taker for your '84 Ford pick-up or an answer to your loneliness, you can now post free classifieds on the Web. Any advertisement that you can fit into four lines and a header will find its way to the four corners of the earth. Of

course, Fun City also allows you to peruse existing ads and seek out exotic trinkets, major merchandise, and individuals even lonelier than yourself. To purchase an item or arrange a rendezvous, just open up your e-mail client and send a note.

<http://www.funcity.com/classifieds/browse.html>

Hot! Hot! Hot! There is a haven for individuals who slice jalapeños onto their breakfast and stash bottles of Texas Pete in their billfolds. Hot! Hot! Hot!'s catalog of combustible condiments offers more than 100 different items and almost as many creative monikers. Sauces named for Johnny Cash tunes (Ring of Fire) and life-affirming epiphanies (Re-

ligious Experience) are grouped according to heat intensity, origin, name, and ingredients. A simple on-line ordering process, a phone, or a fax all give you easy access to this culinary masochism.

<http://www.hot.presence.com/g/p/H3/index.html>

IG Index With IG Index, another of the world's principal vices has made its way onto the Web. This British-based site allows you to bet on everything from the



Web Catalogs and Search Tools

You can't dial 411 and ask for someone's home page. The Web has no official, consolidated directory of sites, nor will it have one anytime soon. Fortunately, several independent companies offer Internet catalogs and search engines that let you find a site without knowing its URL. These tools offer the only systematic means of finding what you're looking for or making sure you've got your search bases covered.

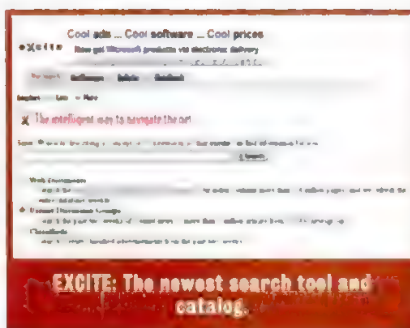
Architext Software's Excite

(<http://www.excite.com>), a recent addition to the Internet's catalog family, serves up two separate navigational tools. NetSearch lets you search for both Web sites and Usenet newsgroups via plain text or keyword methods, while NetReviews offers capsule reviews of Web sites organized in a subject hierarchy.

InfoSeek (<http://www.infoseek.com>) offers both free and cost-based Internet searching. Its free service covers Web sites and newsgroups, but it is often busy and returns only ten matches for each search. The cost-based tool, which can be accessed via several different payment plans, provides a faster connection and access to several unique news databases.

One of the most powerful and comprehensive search sites, **Lycos** (<http://www.lycos.com>) indexes over 7,980,000 pages, which, according to Lycos, covers roughly 91 percent of the Web. Unique features include a formless text search and a list of the Web's 250 most popular sites. Be warned: For basic searches, this powerful tool may make you feel that you're swatting flies with a sledgehammer.

The McKinley Group's **Magellan Internet Directory** (<http://www.mckinley.com>) provides both ratings and exten-



sive reviews for each site listed in its Web catalog. You can browse the catalog by subject or search it by keyword, rating, review size, and category.

The advanced search engine that accompanies the **Open Text Index** (<http://www.opentext.com>) has access to roughly 1 million Web pages. The Open Text crawler tool tracks tens of thousands of pages per day, indexing every word as it goes.

America Online's WebCrawler

(<http://webcrawler.com>), which uses a robot to gather and index Web pages, offers fast, simple searching of a content-based index. There are also interesting pages here devoted to Web statistics and WebCrawler's intriguing Web robot technology.

CERN's Web Servers Directory/Virtual Tourist

(<http://www.w3.org/hypertext/DataSources/WWW/Servers.html>) is a directory of academic and scientific Web servers registered with the World-Wide Web Consortium. The Web Servers Directory has a geographical index, and the Virtual Tourist offers a clickable world map. CERN, however, does not supply a search engine.

The **Whole Internet Catalog** (<http://nearthnet.gnn.com/gnn/wic/index.html>), from Global Network Navigator, is a directory of 1,200 free Web sites, that contains reviews and ratings. The catalog is nicely organized by topic but does not have a search engine.

One of the top search sites on the Web, **Yahoo** (<http://www.yahoo.com>) contains keyword searching and a hierarchical subject guide that is well organized and cross-referenced. Features include Web Launch (a service for announcing your new Web site to the world), a directory of the Web's most popular sites, and Yahoo's list of the coolest home pages.



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HDD	520MB	810MB	520MB	810MB	1.3GB
DISPLAY	10.4" Dual Scan color	10.4" Active Matrix color	10.4" Dual Scan color	10.4" Active Matrix color	10.4" Active Matrix color
WARRANTY	2 year	2 year	3 year	3 year	3 year
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cricket match between England and the West Indies to the price differential between the pound and the deutschmark. After you have set up an account via a Netscape Secure Commerce form (or an insecure form), IG will send you a dealing card that allows you to bet over the phone. Bet to your heart's content, but don't blame us when the bobbies come knocking.

http://www.londonmall.co.uk/ig_index

Internet Shopping

Network If you can wean yourself away from the shopping networks that have overtaken your cable television, you'll find their Internet incarnations provide a more interactive brand of thrills. Whether you're purchasing filet mignon from Omaha Steaks, adding to your cache of Windows 95 apps, or collecting the collectibles at Hammacher Schlemmer, all of your on-line correspondence with ISN is secured by Netscape (insecure and phone orders are also accepted). You can even send flowers to the sweetheart you met while chatting on AOL.

<http://www.internet.net>

Old Sturbridge Village

For those who miss the site of farmers yoking their oxen and children playing rounders in bare feet, Old Sturbridge Village takes you back to the New England of the 1830s. This virtual rendition of the renowned history museum in Massachusetts lets you experience the village's sights, reserve memberships, make travel plans, or purchase crafts, books, and mementos from the museum gift shop. All items must be bought via phone, fax, or mail and are subject to 1996—not 1830—taxes.

<http://www.osv.org>

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O'Reilly and Associates can sell you prudent guidance. Its publications, software, and audiotapes run the gamut of computer-related areas, from X Window to Windows and from programming your PC to living with your PC. Each item is identified by a photograph, a description, brief reviews, and pricing information. Ordering can be done via e-mail (only after you set up an off-line confidential account), mail, phone, or fax.

<http://www.ora.com>

Product Many surf the Web, but not everyone looks good doing it. If you are still clad in ragged jeans and sleeveless

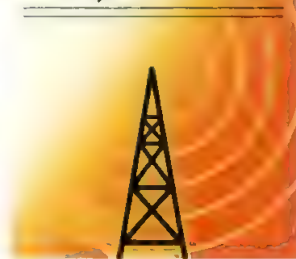
T-shirts, you need Product, your window to the hippest and most outlandish fashions of New York and L.A. Whether you desire Python Pleather Treasures, Silk Charmeuse, or Mongolian Faux Fur, Product will take your ample funds and deliver to your door. Items can't be directly ordered over the network, but your phone line, fax machine, or post office could turn you into a clothes horse with an information-age edge.

<http://www.ProductNet.com>

Speak To Me! This subsite of ClickShop Com has more audio gadgets than a *Dick Tracy* comic strip. A catalog of talking teddy bears, clocks, and bathroom scales offers product photographs, descriptions, and even sound samples. With an .AU player, you can now listen to the sneezing and blessing salt and pepper shakers before deciding to buy. Sound-starved surfers can purchase with a credit card (secure and insecure transactions are available) or with the ClickShop toll-free number.

<http://clickshop.com>

News & Sports



The rapid click of the telex has been replaced by the muffled churn of the hard disk as it caches a news-related home page. Unlike the archaic telex, however, Web browsers aren't limited to the malodorous, smoke-filled offices of your local gazette or the CBS newsroom behind Walter Cronkite; they reside on innumerable personal desk-

tops around the globe, making news delivery faster and more efficient than ever before. While feigning work at the office, you can now use your PC to skim the latest Bill Clinton anecdotes or download a box score for the afternoon ball game at Wrigley Field.

CNN Interactive

The cable television giant that brought you the Larry King/Marlon Brando kiss and kept Saddam Hussein up to date during the Persian Gulf War is now one of the Web's finest multimedia news sources. With its new T3 connection, this busy site allows

you to navigate easily through the day's top events and images or delve into past CNN stories via a keyword search tool. The most impressive feature, however, is the video vault, which covers everything from sports highlights to entertainment news.

<http://www.cnn.com>



Electronic Telegraph

You no longer have to be outside a rainy London Tube stop to read *The Telegraph*. This HTML version of the renowned British newspaper offers not only features, sports, and dismal weather forecasts for the United Kingdom but stellar international stories as well. Its coverage of Europe, Asia, and the Pacific has a perspective that most myopic American services fail to provide. While the rest of the U.S. is eating hot dogs and watching "A Current Affair," you can sit down with tea and crumpets and launch your browser.

<http://www.telegraph.co.uk/>



ESPN SportsZone Since the advent of ESPN, you are no longer a slave to the 900 numbers that dole out sports scores over the phone. Although you'll have to pay for full service, ESPN offers all the perks of its cable TV cousin: scores, stories, stats, schedules, standings, video, and sound. Whether Ken Griffey is watching a ball sail into the upper deck or Gary Kasparov is moving pawn to rook 4, the SportsZone always supplies both updates and analysis.

<http://espnet.sportzone.com>

The Gate If you can pull yourself away from ESPN long enough to realize that San Francisco is more than Barry Bonds, The Gate offers on-line versions of two papers by the Bay: the *Chronicle* and the *Examiner*. Each maintains unique layouts, graphics, and fonts while providing impeccable news, sports, and editorials. While gourmands peruse the Bay



Area Dining Guide, computer enthusiasts will enjoy the recurring Silicon Valley Report. The Valley is ecstatic now that the city's ballpark is named for a router rather than a candlestick.

<http://www.sfgate.com>

Nando Times Raleigh's *The News and Observer* has yet to become a household name in journalistic circles, but its site has gained great popularity both in and out of North Carolina. Although it serves up strong local, national, and international news, many users come for the sports. Nando provides professional stories, stats, and photos matched only by ESPN, but much of its coverage focuses on such local colleges as Duke and NC State. Nothing could be finer than to be in virtual Carolina.

<http://www.nando.net>

NewsLink NewsLink doesn't deliver the goods, but it does point you to them. With a carefully organized design, this Web concordance serves up over 2,000 links to news sites of all genres. You will find national, regional, and campus newspapers, television and radio stations, search sites, publishers, e-zines, and magazines. In a medium that depends heavily on independent catalogs and search tools, this site is a news linchpin that rivals the funny pages in popularity.

<http://www.newslink.org>

Reuters NewMedia When the LED on your laptop's battery begins to blink and you must have the quickest of news fixes, Reuters NewMedia supplies the best in rapid, bare-bones reporting. Adolescent surfers whose sole sources of enjoyment are digital images will scoff at the strictly text-based stories, but this site contains articles on all of the day's events, summaries of top stories, and headlines for the past week. Now there is no excuse not to be up on current events. Your attention span won't be taxed, and newsprint won't rub off on your fingers.

<http://www.yahoo.com/headlines/current/news>

Time Magazine Pathfinder, Time Warner's Internet server, contains an enormous array of political, business, and entertainment info, including complete electronic access to the newsmagazine that has been on coffee tables since 1923. Time Magazine provides the latest domestic and international editions, two years of past issues, and a few features not found in the print magazine. The most welcome feature is Time Daily, which boasts the best late-breaking news on the Web: sharp headlines, terse articles, photos, and links to related stories. Time has become timely.

<http://www.pathfinder.com/time>

USA Today The Web and *USA Today* are a pairing that rivals Tracy and Hepburn. The vivid pages, splashy photographs, and pithy text of the publication known affectionately as McPaper fit perfectly into the Web's colorful, staccato feel. The familiar Life, Money, and Sports sections still keep you up to date on Anna Nicole Smith's whereabouts, Disney's ever-expanding empire, and Dan Dierdorf's latest faux pas on "Monday Night Football." You also get Cyberlistings, a guide to the newest in hip Internet sites and on-line chats.

<http://www.usatoday.com>

The Wall Street Journal Money and Investing Update With a laptop, wireless modem, and the URL for The Wall Street Journal Money and Investing Update, you could be-

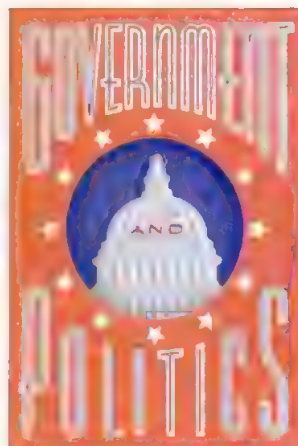


**Has lived in New York all his life.
Never visited the Empire State Building.**



come the most informed trader on the stock market floor. This slick, information-rich site gives you access to reams of company and market news, including coverage of currencies, credit markets, and mutual funds. Stories contain hyperlinks to detailed company profiles offering financial overviews, stock performances, and news. Ivan Boesky never had such advantages.

<http://update.wsj.com/>



Not since Depression-era families sat around the living-room cabinet radio and listened to Franklin Roosevelt's fireside chats has the government come into the home with such intimacy. From trailers in Toluca Lake to brownstones in Boston, citizens can now use the Web to loiter in the halls of Washington D.C.'s most venerable institutions or

actively tap into the latest election-year gossip. Much like the Watergate break-in, however, government sites are typically high on resources and low on technical sophistication.

California Election Servers

If you wish to relive the Di-anne Feinstein/Michael Huffington senatorial photo finish or scrutinize the San Francisco sheriff's job description, you can now do so without jetting off to the California archives. The San Francisco and California Election Servers, which are maintained by Digital Equipment Corp. and the secretary of state, supply pictures and profiles for every candidate, poll results at election time, and state maps that detail each district. A version for the Tagalog-speaking population, which should be a key voting group in '96, is currently in the works.

<http://www.election.ca.gov>

Central Intelligence Agency

For the Walter Mittys of the world who sit at their desks and dream of being Robert Redford in *Three Days of the Condor*, John Deutch and the CIA serve up an intriguing collection of agency publications, maps, and descriptions. A QuickTime video recounts the genesis of this 49-year-old institution at the hands of Harry Truman, while a vir-



tual tour guides you through the agency's D.C. headquarters (a treat that, needless to say, you can't enjoy in person). You can also access the latest edition of the World Fact Book.

<http://www.odci.gov/cia>

Consumer Information Catalog

When you use the trusty U.S. Postal Service to order a government pamphlet like *How to Buy Canned & Frozen Fruits*, the wheels of federal bureaucracy can usually rush it out to you within four to six weeks. The Consumer Information Catalog lets you download the same brochure in only a matter of minutes. An amazing range of topics is covered, including auto-

mobiles, employment, travel, food, nutrition, and investments. You may have to pay for some publications, but you will never be ignorant of foreign-entry requirements or adjustable-rate mortgages again.

<http://www.gsa.gov/staff/pa/cic/cic.htm>

FedWorld Information Network

As the classic electronic bulletin board begins to fade into obscurity, FedWorld still offers access to over 130 government-based BBSs as well as many Web, ftp, and Gopher sites that deal in federal matters. The National Technical Information Service, the agency of the Department of Commerce that runs FedWorld, covers every governmental area you can imagine: space technology, natural resources, health care, transportation, and the military.

<http://www.fedworld.gov/>

GPO Gate Whether you're intrigued by Bill Clinton's role in the Whitewater scandal or the radio broadcast services of Clinton, Kentucky, a keyword search on the GPO

Gate Web page will uncover more information than a federal subpoena. The University of California at San Diego, the founder of GPO, serve up the full text of several U.S. Government Printing Office publications, including the Fed-

eral Register, the Congressional Record, the Senate and House calendars, and the United States Code.

<http://ssdc.ucsd.edu/gpo>

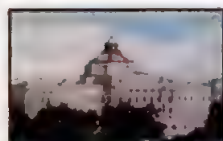
The Library of Congress

At the Library of Congress's site, you gain access to over 70 million documents without having to endure cranky librarians. This 195-year-old library offers access to the U.S. Copyright Office, digitized documents of American cultural and historical significance, descriptions of federal events, indexes, and THOMAS, a Web version of the Congressional Record and other Capitol Hill publications. Also at this site: a stunning collection of exhibits called American Memory.

<http://www.loc.gov>

**Was born and raised in Paris.
Has never been to the top of the Eiffel Tower.**





The Library of Congress

Founded in 1800

THE LIBRARY OF CONGRESS: Check it out.

The United Nations You can now visit this 50-year-old institution without having to brave the traffic on the FDR Drive or talk your way past security at Dag Hammarskjöld Park. The handsome U.N. home page offers tours of its famous facility, conference updates, summaries of General Assembly activities, news releases, Security Council information, and multimedia coverage of the fiftieth-anniversary celebration.

<http://www.un.org>

The United States Department of Justice If you suddenly uncover information on the Unabomber and could make good use of the reward, this site lets you e-mail your startling discovery directly to an FBI agent. The Department of Justice—which oversees the FBI, DEA, and INS—is a hub of information on legal organizations, government legislation, presidential policies, and law enforcement. Most important, however, it keeps you up to date on the nation's leading criminals. The Ten Most Wanted List is among this site's most popular features.

<http://www.usdoj.gov>

The U.S. Census Bureau The Census Bureau home page isn't just for frustrated statisticians who can ingest more numbers in an afternoon than Al Capone's bookkeeper. In addition to straight population stats, the Bureau also provides demographics relevant to current debate (such as mothers receiving public assistance), leading economic indicators like monthly wholesale trade and

housing starts, and software tools that let you extract information from its enormous databases. But if you want to verify the population of Sparta, North Carolina, in 1914, no one is going to stop you.

<http://www.census.gov>

The White House The last time the president was this accessible, James Garfield was shot on his morning walk. The White House home page offers intimate portraits of First Family life, tours of Hillary's gardens, and audio files of Socks's meow, not to mention Executive Branch publications, press releases, and databases. President Bill Clinton



THE WHITE HOUSE: Say hey to William J.

and Vice President Al Gore each offer digital audio welcome greetings, to which you can respond via the on-line guest book. Don't let your comment get too rough, though; the Secret Service is TCP/IP-literate.

<http://www.whitehouse.gov/>



The next time an unkempt encyclopedia salesman raps on your front door and forces several volumes into your arms, tell him you have an Internet connection and shove him into the azaleas. The Web, after all, offers instant access to more reference material than the lost library of Alexandria. Whether you are seeking a synonym for *love*, the way to

San Jose, or the man who said "The only way to get rid of a temptation is to yield to it," all the information you need is in hypertext format that doesn't require shelf space. J.P. Morgan would be appalled, but Tim Berners-Lee is ecstatic.

ARTFL Project: Roget

Form If composing poetry for your sweetheart involves supplementing your limited vocabulary with obscure, multisyllabic words, you must have this digital version of Roget's familiar thesaurus at your side. When you search on a phrase, word, or headword (category of synonyms), you immediately jump to the appropriate section of the thesaurus's text. The item you typed in is highlighted, and hypertext links to other, related sections are easily accessible. Just be sure you know what

effluvium means before you use it in your Shakespearean sonnet.

http://humanities.uchicago.edu/forms_unrest/ROGET.html



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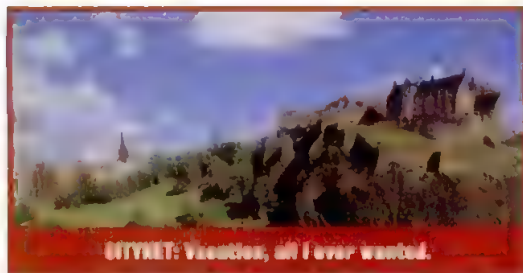
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CityNet provides detailed descriptions, guides, maps, photos, magazines, and transportation information for cities and hamlets in every country from Scotland to the Côte d'Ivoire. Soon you will know more about the world's great vacations than Chevy Chase. <http://www.city.net>

Network is a truly worldwide collection of sites, including the Poisons Information Database at the National University of Singapore, the Canadian Diabetes Association, and the Nottingham School of Public Health. If this flurry of Web browsing has made you ill, you've come to the right place.

<http://www.pitt.edu/HOME/GHNet/GHNet.html>

History of Science, Technology and Medicine

If your cohorts continue to beat you at Trivial Pursuit because you can't remember where Lucy was discovered or who invented calculus, log on to the History of Science home page. This subsite of the World-Wide Web Virtual Library contains an excellent biographical dictionary, documents on every area of technology, a directory of scientific institutions, and electronic journals. Relativity and quantum mechanics are covered, but you'll have to go elsewhere for Silly Putty and Slim Fast shakes.

http://www.asap.unimelb.edu.au/hstm/hstm_ove.htm

Internet Public Library

The University of Michigan has more to offer than just a catchy fight song. Michigan's Internet Public Library has succeeded in migrating all the varied resources of your local bibliotheca into the digital realm. IPL's reference materials, children's sites, reading rooms, and exhibit halls let you bone up on your accounting, enjoy a bedtime story, pore over the world's great banned books, and delve into African American history. Hail, hail to IPL, champion of the Web.

<http://ipl.sils.umich.edu/>

The Tech Classics Archive

In a world of Achilles' heels, Oedipus complexes, platonic relationships, and cesarean sections, you ought to know your classic texts as well as you know your sitcoms. The Tech Classics Archive provides such an education with translations of 376 Greek, Roman, and Italian texts, including Homer's *Odyssey*, Virgil's *Aeneid*, and Machiavelli's *The Prince*. Considering its keyword search tool and its author, title, date, and translator indexes, you may even discard your Cliffs Notes collection.

<http://the-tech.mit.edu/Classics>

Bartlett's Familiar Quotations

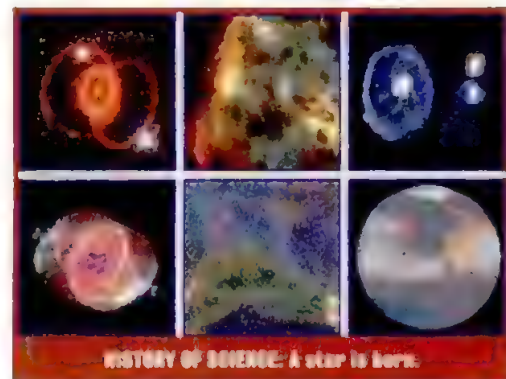
John Bartlett's publication of witticisms and poignant sayings—one of the most important accessories a front parlor can have—is even better in HTML. Instead of thumbing through multiple indexes, you can now search electronically for keywords or pick authors from chronological and alphabetical listings. With quipsters ranging from Lord Byron to Muhammad Ali, you'll always have words on hand to woo that intriguing person in Marketing or insult the office rival who keeps sending you nasty e-mail.

<http://www.cc.columbia.edu/acis/bartleby/bartlett>

The Complete Works of William Shakespeare

If you are among those who insist the Web is "full of sound and fury, signifying nothing," behold this HTML monument to the Bard himself: the standard works of Shakespeare now digitally accessible and neatly arranged in hypertext format. Plays contain separate links for each scene, synopsis, or dramatis persona but can also be viewed as continuous text. An integrated hypertext glossary even lets you instantly look up those arcane Elizabethan words that were so baffling in junior high.

<http://the-tech.mit.edu/Shakespeare/works.html>



The Encyclopedia Mystica

No matter how far society advances, we still cling to our myths. Atlantis and Avalon, Beowulf and Theseus, sprites and unicorns are all alive and well on the Web thanks to Encyclopedia Mystica, a thorough collection of mythology, folklore, and legends (albeit with spartan graphics). Before the gnomes, goblins, and hobbits take over your machine, you can submit your own articles to the encyclopedia, peruse links

to related pages, or browse an extensive bibliography of sources.

<http://www.bart.nl/~micha/mystica.html>

The Global Health Network

This hangout of choice for interns and hypochondriacs covers countless injuries, ailments, remedies, and elixirs. As its name implies, The Global Health

Network is a truly worldwide collection of sites, including the Poisons Information Database at the National University of Singapore, the Canadian Diabetes Association, and the Nottingham School of Public Health. If this flurry of Web browsing has made you ill, you've come to the right place.

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Don't chastise your kids for spending too much time on the Web. They may be studying up for the GRE or sending out HTML-based resumes. Despite its reputation for frivolity, the Web is actually one of the most impressive places to turn for educational and career opportunities. In case you are tired of your hometown wantads and

high school-equivalency commercials, your browser now lets you search for jobs nationwide, publicly post your resume, and ease the ordeal of getting into college.

America's Job Bank

Unlike most seasoned, crotchety organizations, the over-60-year-old public Employment Service has adapted to the times and technologically reinvented itself. Its America's Job Bank has migrated to the Web, where it offers information on roughly 250,000 employment opportunities. Job seekers can easily search through AJB's nationwide database, dig into its more than 1,800 state offices, or go straight to employer-maintained listings. And if your trust fund is on its last legs, you will be happy to know that AJB is completely free.

<http://www.ajb.dni.us/index.html>

CareerPath.com Instead of enduring the withering stares of the strange man at the corner newsstand as you shell



out correct change for an unmanageable stack of newspapers, you can now scan the employment advertisements of six of the nation's leading dailies without leaving your homely hovel. CareerPath.com contains the complete Sunday ads for the *Boston Globe*, *Chi-*

cago Tribune, *Los Angeles Times*, *New York Times*, *San Jose Mercury News*, and *Washington Post*. Each of these fine publications can be searched by discipline, keyword, and date, but not by salary, office size, or benefits.

<http://www.careerpath.com>



Career Resources Home page

Before you assume that the Rensselaer Polytechnic Institute offers nothing more than superconducting supercolliders and Van de Graaff generators, spin by its Career Resources Homepage, which provides a unique array of on-line employment services. The Internet Job Surfer links to several commercial databases, while Employer's Direct forwards you to companies that are looking to hire for themselves. Several other professional- and university-based services are also available, including CyberAlumni, which will help you connect to your alma mater's influential graduates and ask for help.

<http://www.rpi.edu/dept/cdc/homepage.html>

careerWEB Like the Valentine's Day computer dating service you tried last year, careerWEB could pair you with happiness. With its enormous database of employers, franchisers, and career-related companies, a connection between you and your next paycheck is imminent. You can search by job, location, employer, or keyword; browse employer profiles; and peruse the careerWEB Library's list of related publications. If you aren't easily depressed by bad news, a career fitness test will even analyze your strengths and many weaknesses.

<http://www.cweb.com/>

Financial Aid

Information When Yale accepts you (or your son or daughter) for the full term and you can't dig the tuition out of your porcelain piggy bank, the Financial Aid Information home page may be your savior. Mark Kantrowitz's collection of



books, phone numbers, Usenet newsgroups, services, bibliographies, and mailing lists gives you a roadway to all the latest grants, loans, scholarships, and fellowships. It also offers FastWeb—a searchable database of even more financial information—and a plug for Kantrowitz's magnum opus, *The Prentice Hall Guide to Scholarships and Fellowships for Math and Science Students*.

<http://www.cs.cmu.edu/afs/cs.cmu.edu/user/mkant/Public/FinAid/finaid.html>

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Financial Aid Information

FINANCIAL AID INFORMATION: Scholar tips

IntelliMatch The Web has its 221b Baker Street. Once you access the IntelliMatch home page and fill out a Watson resume, hundreds of potential employers will have access to your profile via the Holmes search software. An On-line Job Center link—which provides information on participating companies, describes available jobs, and details other job-related sites or products—lets you actively search for a position, but you may want to sit back and let the two British sleuths work their magic.

<http://www.intellimatch.com>

Internet College

Exchange If you are ready to matriculate, the Internet College Exchange can help you develop a list of potential colleges, select the ideal school from that list, fill out an application, look into financial aid, and respond to your acceptance letter. There are also special links for parents and counselors, a bookstore, a newsletter, and a list of all major U.S. colleges that have Internet sites.

<http://www.usmall.com/college>

The Internet's Online Career Center

The Internet's self-proclaimed "first and most frequently accessed career center" is short on modesty but long on employment resources. You can search the Online Career Center's job databases by industry, state, city, or keyword, read up on nationwide career fairs, and seek out advice. Unlike other career sites, this one lets you post resumes in HTML format. You can use photographs, rich text, graphics, audio, video, and hypertext links to liven up your sparse job experience.

<http://www.occ.com>

The Monster Board Why The Monster Board has its name is still a mystery, but it certainly contains impeccable employment resources and intriguing art. Its roughly 45,000 job opportunities from over 700 corporations can be browsed manually or searched with a keyword engine as you're entertained by an eclectic collection of bright and beguiling creatures. Several other impressive features,

such as a resume database, employer profiles, an employment e-zine, and career fair updates, will take your mind off the unemployment line. Throw in the Monster Board T-shirt and you're set for life.

<http://www.monster.com/home.html>



The hardcover seems to be going the way of silent films, and even magazines may be an endangered species as the published word shifts toward ever more ethereal media. To augment the hip rags that already grace the nation's newsstands, the Web offers many publications that exist only in cyberspace. These e-zines (electronic magazines)

are a far cry from the paper magazines scattered around your house; they're intense, highly graphical, and navigable only via the wonders of hypertext. Unlike their glossy counterparts—which may go to press months before you see them—Web publications even have the means to be perpetually current.

The Biz If you are shooting a film in between stints at Burger King or trying to break into the mailroom at William Morris, you have to be on top of the ins, outs, and back stabbings of the entertainment industry. The Biz, a New York-based e-zine from Marinex Multimedia, brings you such rich information via its prime assortment of interviews, features, columnists, home video guides, movie trailers, statistics, and industry news. Now, you will never again be ignorant of Brad Pitt's latest projects or Kevin Costner's efforts to run his career into the ground.

<http://www.bizmag.com/>

Crashsite This e-zine's kicker—"where chaos, horsepower, and madness unite"—may sound like a plug for an outlaw motorcycle gang, but don't hesitate to leap into its blitzkrieg of hypertext and



Testprep.com If your SAT scores are lower than your last weigh-in and you've spent your last dollar on the latest issue of *People* magazine, the Testprep.com home page offers free access to several preparation materials that will turn you into a standardized test wonder-kind. Current services include on-line SAT practice tests, a TestPrep SuperStore for purchasing related merchandise, and software that will analyze your test-taking habits. By the first of the year, practice tests for the ACT, GRE, LSAT, MCAT, and other dreaded acronyms will also be available.

<http://www.testprep.com>



multimedia. Crashsite's tribute to short attention spans and random access is nineties entertainment in the vein of amusement parks and extravagant video games. You are bombarded with quicktime movies, digital screams, posters, Japanimation, music, and crass commercialism. The ability to read is not required.

<http://www.crashsite.com/Crash>

Cyber Culture After a visit to Crashsite, the Cyber Culture home page will read like Miltonic verse. In contrast to most e-zines, this text-intensive site serves up cerebral essays, articles, fiction, thoughts, and questions while maintaining a common thread. That thread, of course, is cyberspace itself, which manages to spawn a surprising number of engaging concepts. Recent Cyber Culture offerings include an essay on "The Dark Side of Cyber Romance," a tale of artificially intelligent computer viruses, and a realization that the Web is a completely waste-free medium.

<http://cyp.onramp.net/cyber/cybermag.html>

CyberWire Dispatch Brock N. Meeks's CyberWire Dispatch is a pencil sketch hanging among the Warhols. It contains no graphics, video files, sound bytes, or garish colors—only one man's intriguing insights and his smiling black-and-white photograph. Meeks posts his Internet-related columns roughly every two weeks, but an archive of over 80 articles on a variety of intriguing topics should keep you going between postings. Each flip, intelligent column begins with Meeks jacking in from some random port (the "Where's Pat Garrett When You Need Him?" port, for instance) and closes with a terse "Meeks out."

<http://cyberwerks.com:70:1/cyberwire>

FEED This brilliant e-zine is an interwoven collection of in-depth stories (Feature), analyses of culture (Feedline), reviews of important publications (Document), and discussions (Dialog). The subjects of these services will vary from the history of Muzak ("Only two companies have ever prospered from products that almost no one admits to liking. One is Hormel, maker of Spam. The other is Muzak.") to the patenting of human genetic material, but you'll always get a mouthful.

<http://www.feedmag.com>

HotWired This Web incarnation of *Wired* (the hippest of the hip computer rags) is where pop-cultural Rip van Winkles can get back up to speed. HotWired delivers the best in alternative sports, gossip from the digital revolution, back issues of *Wired*, Web interaction with the digerati, and twenty-first-century art exhibitions. If you can handle such excruciating coolness, you also get a second dose of Brock N. Meeks and a virtual speakeasy.

<http://www.hotwired.com/>

Hype Don't dare to call Hype an e-zine; it's an ElectraZine. Presumably, the *Electra* prefix refers to this site's unrivaled graphics. Hype offers sound clips of the latest musical genres, a few humorous cartoons, links to other nifty sites, and an audio player, but its strengths stem from an in-your-face design. From the opening logo to the perpetually changing background art, you get some of the most vivid graphics HTML has to offer. Of course, Hype also wins the award for the Web's most apt appellation.

<http://www.phantom.com/~giant/hype.html>

Suck Hiding behind such pseudonyms as the Duke of URL, Suck's contributors do nothing but dish out hilarious screeds full of unbridled Web sarcasm. Unlike most e-zines, which lack regularly scheduled updates, Suck is updated daily with a piece that will have you howling and its subject seething. No person, company, or thing is safe from Suck's flip critiques and scathing indictments—not CompuServe, Michael Kinsley, Netscape, nor the ubiquitous Spam. Not even Suck is off limits to Suck.

<http://www.suck.com>



Urban Desires As its subtitle states, Urban Desires is "an interactive magazine of metropolitan passions." This slick e-zine has amazingly adept book reviews, art critiques, celebrity interviews, and travel journals. Its cover art is always engaging and attractive, and each story is accompanied by its own blend of photography and graphic design. You may submit art, articles, or photographs to the managing editor, but make sure your work carries the right look and feel; Urban Desires has more dark downtown attitude than a Scorsese film.

<http://desires.com/issues.html>

Word Next to the icons that do cartwheels courtesy of the Java programming language, this distinctively constructed e-zine serves up some of the best in kinetic Web art. As Word pages download, objects spin, graphics announcements appear and vanish, and sets of lips mouth a few phrases your way. Aside from such novelties, Word also contains an unending supply of articles, fiction, poetry, exhibits, photography, and astounding art in a range of unexpected categories: habit, gigo (garbage in, garbage out), place, desire, work, money, fresh, and machine. Things are no longer as simple as news, weather, and sports.

<http://www.word.com/index.html>

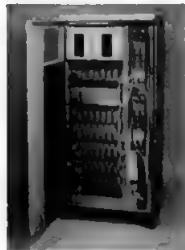


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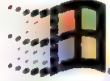
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There are many portable computers from leading manufacturers priced like the new TI Extensa™ 550. Trouble is, they probably don't come with Pentium® processors. They use DX4 or DX2 processors to power the machines. That's a whole generation—or two, behind.

And that's just the beginning. The new TI Extensa 550 extends the power of its Pentium processor with 256KB of L2 cache, allowing the processor to work at maximum operating efficiency.

What's more, the TI Extensa 550 uses the same circuitry (called Peripheral Component Interconnect or PCI) used in most desktop models for blazingly fast video monitors and improved disk drive performance. The TI Extensa 550 also comes with a serial infrared port, which lets you print or share files, wirelessly.

Thus enabling the TI Extensa 550, and its owner, to do some extraordinary things.

To get your own TI Extensa 550 or to find out about our other models, call 1-800-TI-TEXAS. E-mail: 2ti@msg.ti.com. Internet: (<http://www.ti.com>).

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In an era when silence and darkness are considered sadistic deprivation, the Web succeeds because it manages to deliver more sensory stimulation than a session of shock therapy. Not only is the art of Michelangelo, Picasso, and Mapplethorpe available through digital imagery, but the musical works of Mozart, Gershwin, and David Cassidy can be experienced via digital audio. The only obstacle to such culture is locating the army of viewers required to read the Web's disparate multimedia formats. If you download a few viewers from our Top Ten Internet Resource sites, your browser will become both museum and concert hall.



THE LOUVRE: French bliss.

The Louvre For those dreamers who perpetually talk of relocating to Paris but will never find the chutzpah or the French to do so, the world's most renowned art museum has developed a virtual tour of its facilities. The Musée de Louvre Web site offers the museum's vital information (address, telephone number, daily hours, admission fees, and proximity to the Metro) in addition to a short overview of its history, a digital rendition of its floor plan, and reproductions of its greatest works of art. To boot, no one can stop you from taking flash photographs of the *Mona Lisa*. GIF file. <http://www.paris.org/Musees/Louvre>

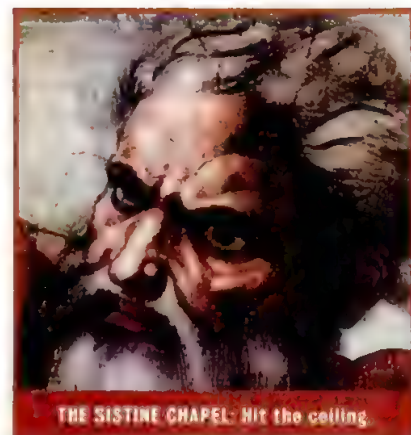
MTV Online If your daily 24-hour dose of MTV is no longer enough, its cyberspace sibling now lets you double

your pleasure. MTV Online contains all the links that you'd expect ("Top 20," "MTV News," "120 Minutes," Buzz Clips," music reviews, VJ profiles, and videos on regular rotation), not to mention some of the Web's most resplendent art. Of course, you also get coverage of MTV's alternative programming—including the "The Real World" and "Beavis and Butt-head"—assuming that you haven't had your fill of such disaffected youngsters.

<http://www.mtv.com>

The National Museum of American Art The National Museum of American Art is expanding into cyberspace via this highly interactive Web site. With access to the NMAA's video tours, docent voice clips, and almost 1,000 pieces of art, you'll feel as if you just walked into the museum's west wing from the National Portrait Gallery next door. You can delve into the NMAA research facilities, educational opportunities, and special exhibits without having to brave a busload of tourists. <http://www.nmaa.si.edu:80>

the place The Web has not only spawned e-zines but given rise to electronic galleries as well ("e-galleries" as a word has yet to catch on). The place, a site created and maintained by Joseph Squier, displays several digital works that have



THE SISTINE CHAPEL: Hit the ceiling.

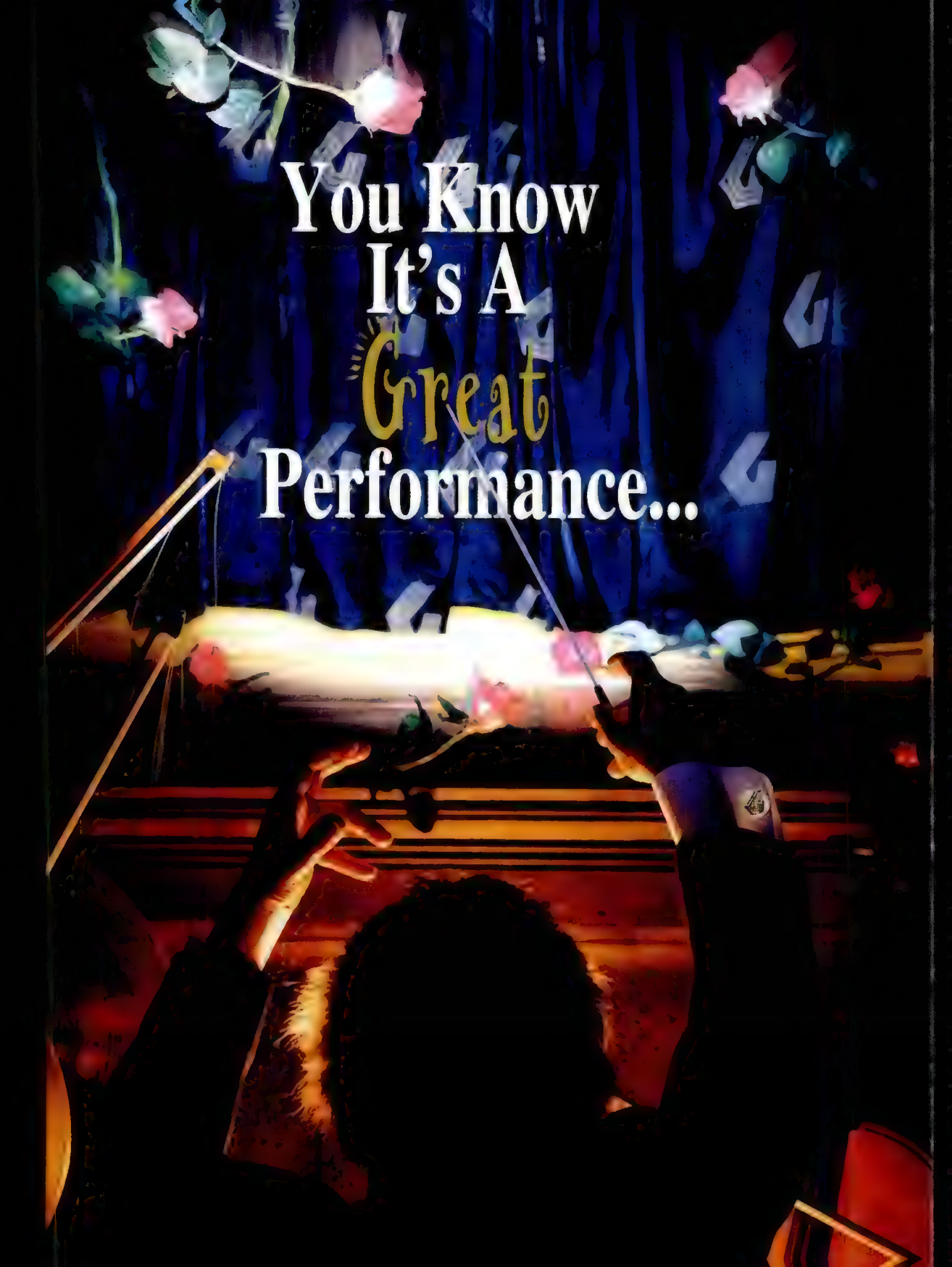
been produced specifically for the Web. Each piece begins with a spot of poetic text, then moves into a series of interwoven, hyperlinked images. Although these works are supplemented with a list of other art sites, outside reviews of the place, essays, and a brief bio, you'll probably spend most of your quality time examining the multilayered imagery of Squier's *Urban Diary*.

<http://gertrude.art.uiuc.edu/ludgate/the/place/place2.html>

Rock and Roll Hall of Fame From Woody Guthrie's "This Land Is Your Land" to Dr. Dre's "Nuthin' but a G Thang," the newest Cleveland landmark now gives you Web access to the songs and the artists that shaped the world of rock and roll. The Hall of Fame home page contains profiles of each inductee, color photographs, subtle graphics, and more .WAV, .AU, and Real Audio (<http://www.RealAudio.com/>) files than you can shake a drumstick at. The real kicker, however, is a virtual tour of Cleveland. <http://www.rockhall.com>



MTV: Heavy rotation.

A dramatic scene of a person lying on a stage, possibly a performer, with flowers and spotlights. The person is lying on their back, and their head is visible in the foreground. The stage is decorated with flowers, and there are spotlights illuminating the scene. The background is dark, and the overall atmosphere is one of a theatrical performance.

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And if it belts out power performance and sound like no other, then it's gotta be a Gateway 2000® computer! The new Intel® 166MHz Pentium® processor is the fastest Pentium processor available today. And Gateway's high-end P5-166XL professional multimedia system will provide you with extraordinary performance, even for your most robust computing needs. Top it off with Gateway's exclusive Altec™ Lansing ACS-400 speakers, and the P5-166XL ushers you into first-rate stereo sound!

An Encore 166MHz Performance

Bravo! You'll leap to your feet when you experience all the powered-up features of the P5-166XL. This impressive system is built standard with 16MB EDO performance DRAM, 256K pipelined burst cache and 2GB hard drive for unbeatable performance. In fact, we expect our P5-166XL to blow all other Pentium processor-based PCs off the map!

Maestro of Multimedia

Spine-tingling, heart-thumping stereo sound resonates from your Altec Lansing ACS-400 speakers, standard on the P5-166XL and exclusively from Gateway 2000. With an included ACS-250 subwoofer, these speakers give you thunderous bass and extraordinary Dolby® Surround Sound, breathing new life into all your multimedia applications and music CDs! The Ensoniq® Wavetable sound card is also standard on the P5-166XL. You'll be amazed by the ultra-realistic sound of the Ensoniq's wave table synthesis technology.

Could we possibly enhance your multimedia experience more? Yes! Now our P5-166XL, and all Gateway 2000 Family PC™ multimedia systems, also include MPEG (Moving Picture Experts Group) data compression technology. Not only will MPEG technology provide superior stereo sound, it also gives you incomparable full-screen, full-motion video right from your CD-ROM drive. Video from MPEG multimedia applications will be smoother, and soon all your favorite movies will be available on CD! The P5-166XL also includes a super-fast 6X CD-ROM drive for the latest CD-ROM drive technology available.

The P5-166XL adds all these performance features to a Matrox® 2MB WRAM graphics accelerator with MPEG video scaler. So now your 3-D graphics and multimedia applications will run with incredibly smooth video playback.

A Fax/Modem Virtuoso

All your communication needs will be filled with the P5-166XL's included TelePath® 28.8 fax/modem! You may know that Gateway's TelePath fax/modem is state-of-the-art, using the AT command set and including FaxWorks communications, fax and file transfer software package. But there's more. The TelePath fax/modem is also a complete communications tool with its Telephone Answering Device (TAD) for answering machine and voice mail capabilities!

Your TelePath 28.8 fax/modem includes Gateway's Information Highway communications CD, featuring a user-friendly interface and easy-to-use tutorial of included trial memberships to CompuServe®, Prodigy®, America Online® and Reuters Money Network. You'll also receive GNN (Global Network Navigator) for easy access to the Internet.

Software Diva

And for the grand finale: The P5-166XL has the *best* software bundle found *anywhere* with Gateway's Ultimate Software Bundle! It includes MS Office 95, Professional Edition and Gateway's Generations II Software Collection for use with the Windows 95 operating system. It's all you'll ever need for business applications in the Windows 95 environment, *and* for the most complete, updated versions of the latest and greatest multimedia applications, most optimized for Windows 95. A gaming pad is included in the Ultimate Software Bundle for use with all your entertainment software. Call and ask how you can upgrade other Gateway 2000 systems to get the Ultimate Software Bundle.

Primo Gateway Gold Premium

All Gateway systems come with our superb Gateway Gold™ service program for unbeatable and award-winning support, including toll-free technical support for the life of your Gateway computer. The P5-166XL gives you even more with Gateway Gold Premium, adding an extended three-year on-site agreement** and a priority 800 number for access to technical experts. Call today and ask for details on our celebrated Gateway Gold programs!

** Call or write us for a free copy of our on-site service agreement.

If You *Accomplish* Things You Never Thought Possible...

And if your model for success includes a real brainy computer, then it's just got to be a Gateway! Got a bright idea or two? All Gateway 2000® professional systems are power-packed machines built to handle any mastermind project.

Gateway Professional Systems — An Ingenious Performance

All Gateway professional Pentium® processor-based systems have EDO performance DRAM, and most come standard with pipelined burst cache. These features will give you a faster, more cost-effective means to great performance. And for extraordinary levels of performance, Gateway's P5-133 Professional system includes the ultra-fast 133MHz Pentium processor and is standard with 16MB EDO performance DRAM and 256K pipelined burst cache. Gateway utilizes EDO and pipelined burst cache memory technologies for the best performance — *anywhere*.

All your heavy-duty business applications will run at top speed with the industry's latest 6X CD-ROM drive, standard on the P5-133. This CD-ROM drive performs 50% faster than a 4X CD-ROM, and with 6X technology you'll be ready for tomorrow's complex software applications. Renowned for unconventional wisdom when it comes to value, Gateway 2000 brings you the P5-133 Professional system for just \$2,949!

The Right Equation

Gateway PCs include the Microsoft® Windows® 95 operating system, and our Professional models all tout MS Office 95, Professional Edition or MS Works 95, both compatible with 32-bit performance and backward compatibility for 16-bit applications. When you buy a system from Gateway, we'll also give you a choice of operating systems. Whether it's MS-DOS® and Windows for Workgroups, Windows NT, or Windows 95, Gateway 2000 will meet all your computing needs.

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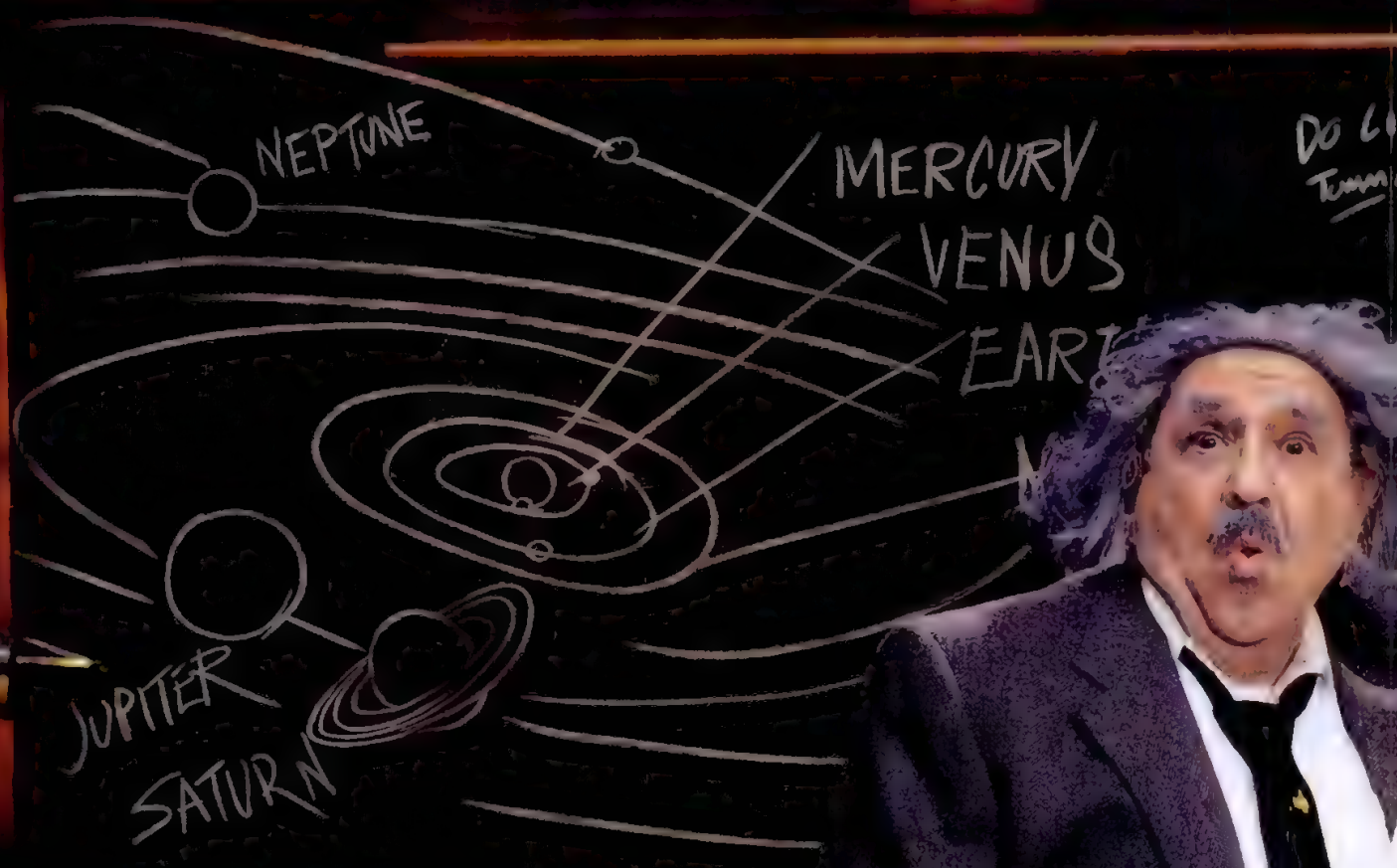
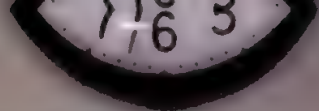
It's a proven theory. Noble and friendly Gateway 2000 employees provide our customers with the best possible service and support in the PC industry. When surveyed, *Computer Shopper*® readers answered "Gateway 2000!" unequivocally and bestowed us with *Computer Shopper's* 1995 Best Overall Hardware Service and Support award.

Presenting the Best Performance in the Industry!

For the fifth consecutive year Gateway 2000 swept the *Computer Shopper* Best Buy awards! We're proud to announce that *Computer Shopper* readers awarded us with these coveted *Computer Shopper* awards: Best 486 Desktop (486DX2-66), Best Pentium Desktop (P5-133XL), Best Multi-media PC (P5-120 Family PC multimedia system), and Best Overall Computer Systems Supplier!!

It's All Relative

Call today and ask about Gateway's Professional computers. They're the only logical solution to your demanding business and professional computing needs! And we'll custom build any computer to fit your exact specifications.



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If You're In Awe Of Your High-Flying **Multitasking** Machine...

The Gateway 2000® G6-200: A Legendary Performance

And if you just can't function without jet-set workstation power and performance — we're talking the top-flight machinery available today — then a new Gateway 2000 G6-200 is definitely for you! This new generation of workstations combines a 150MHz or 200MHz Intel® Pentium® Pro processor with the Windows NT™ Workstation operating system and a configuration that'll send you soaring into the wild blue computing yonder!

Pilot Your 200MHz Pentium Pro

The Pentium Pro processor is Intel's latest generation processor designed to provide workstation users with ultra-high performance in true 32-bit environments. The Gateway G6-200 is classified as a value workstation, perfect for Cad applications, intense desktop publishing, and graphics and design applications. If you require a load of memory and storage space to run your heavy-duty network applications, you won't find a better value from any other workstation manufacturer.

High-Flying Performance Features

To achieve the high throughput and superior performance your intense applications require, we've included a 2GB SCSI hard drive on the Gateway G6-200. SCSI technology offers better performance in workstation environments. The SCSI interface allows you to connect up to seven internal SCSI devices, so you can expand like never before. The G6-200 also includes the Adaptec® 2940 PCI Ultra SCSI controller card. Combine all this with 64MB DRAM and your workstation applications will fly!

Gearing Up for Great Graphics

With the Matrox® 2MB WRAM video card standard on the G6-200, you'll get incredible graphic support, including support for hardware accelerated 3-D. For work in higher resolutions, you can upgrade to 4MB WRAM for increased color depth and 3-D support in workstation environments.

Workstation Wonderland with Windows NT Workstation

All right, Windows NT Workstation customers, you know who you are. And we want to get to know you! Gateway 2000 now proudly offers you the best value on the Windows NT Workstation 3.51 operating system in the industry, standard on Gateway's G6 models. This is one of the most powerful operating systems for any organization that depends on a computer for today's most demanding data-intensive business applications. And if you value the reliability and security of privacy in large workstation environments, Windows NT Workstation is perfect for you.

Great news Windows NT 3.51 users! Your Gateway 2000 G6 system will arrive pre-loaded with Windows NT Workstation, ready to run! Simply determine and enter your individual security codes and passwords during initial setup. We'll configure all G6 systems with the appropriate Windows NT 3.51 drivers, loaded and optimized for compatibility with Gateway hardware and software.

Along with Windows NT, you get MS Office 95, Professional Edition for the best 32-bit business software applications available. And you can upgrade the P5-133 and P5-120 systems to Windows NT for a value that can't be beat! Call today for more information on our new G6 computers.

The G6-200 Professional system has not been approved by the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased until the approval of the FCC has been obtained.



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inside
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PROCESSOR

Multimedia Systems

P5-75 FAMILY PC™

- Intel® 75MHz Pentium® Processor
- 8MB EDO Performance DRAM
- 850MB 10ms EIDE Hard Drive
- 1MB DRAM, 64-Bit PCI Graphics Accelerator with MPEG Video Scaler
- 4X EIDE CD-ROM Drive
- 16-Bit Gateway Sound Card
- Altec™ Lansing ACS-40 Speakers
- TelePath® 14.4 Fax/Modem with TAD*
- Gateway Information Highway CD
- 3.5" Diskette Drive
- 14" .28dp CrystalScan® Color Monitor (13.25" viewable)
- 7-Bay Desktop Case
- 104* Keyboard & MS Mouse 2.0
- Microsoft® Windows® 95
- Generations II Software Collection
- Gateway Gold™ Service & Support

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P5-100 FAMILY PC

- Intel 100MHz Pentium Processor
- 8MB EDO Performance DRAM
- 1GB 10ms EIDE Hard Drive
- 2MB DRAM, 64-Bit PCI Graphics Accelerator with MPEG Video Scaler
- 6X EIDE CD-ROM Drive
- 16-Bit Gateway Sound Card
- Altec Lansing ACS-40 Speakers
- TelePath 28.8 Fax/Modem with TAD*
- Gateway Information Highway CD
- 3.5" Diskette Drive
- 15" .28dp CrystalScan Color Monitor (13.8" viewable)
- 7-Bay Desktop Case
- 104* Keyboard & MS Mouse 2.0
- MS Windows 95
- Generations II Software Collection
- Gateway Gold Service & Support

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P5-120 FAMILY PC

- Intel 120MHz Pentium Processor
- 16MB EDO Performance DRAM
- 1GB 10ms EIDE Hard Drive
- 2MB DRAM, 64-Bit PCI Graphics Accelerator with MPEG Video Scaler
- 6X EIDE CD-ROM Drive
- 16-Bit Gateway Sound Card
- Altec Lansing ACS-40 Speakers
- TelePath 28.8 Fax/Modem with TAD*
- Gateway Information Highway CD
- 3.5" Diskette Drive
- 15" .26dp Vivitron™ Color Monitor (14.0" viewable)
- 7-Bay Desktop Case
- 104* Keyboard & MS Mouse 2.0
- MS Windows 95
- Generations II Software Collection
- Gateway Gold Service & Support

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P5-166XL

- Intel 166MHz Pentium Processor
- 16MB EDO Performance DRAM
- 256K Pipelined Burst Cache
- 2GB 10ms EIDE Hard Drive
- Matrox® 2MB WRAM Graphics Accelerator w/ MPEG Video Scaler
- 6X EIDE CD-ROM Drive
- 16-Bit Ensoniq® Wavetable Sound Card
- Altec Lansing ACS-400 Speakers w/ ACS-250 Subwoofer
- TelePath 28.8 Fax/Modem with TAD*
- Gateway Information Highway CD
- 3.5" Diskette Drive
- 17" .26dp Vivitron Color Monitor (16.0" viewable)
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- MS Office 95, Professional Edition**
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Professional Systems

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- Intel 75MHz Pentium Processor
- 8MB EDO Performance DRAM
- 850MB 10ms EIDE Hard Drive
- 1MB DRAM, 64-Bit PCI Graphics Accelerator
- 4X EIDE CD-ROM Drive
- 3.5" Diskette Drive
- 14" .28dp CrystalScan® Color Monitor (13.25" viewable)
- 7-Bay Desktop Case
- 104* Keyboard & MS Mouse 2.0
- MS Windows 95
- MS Works 95
- Gateway Gold Service & Support

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P5-100

- Intel 100MHz Pentium Processor
- 8MB EDO Performance DRAM
- 256K Pipelined Burst Cache
- 1GB 10ms EIDE Hard Drive
- 1MB DRAM, 64-Bit PCI Graphics Accelerator
- 4X EIDE CD-ROM Drive
- 3.5" Diskette Drive
- 15" .28dp CrystalScan Color Monitor (13.8" viewable)
- 7-Bay Desktop Case
- 104* Keyboard & MS Mouse 2.0
- MS Windows 95
- MS Office 95, Professional Edition**
- Gateway Gold Service & Support

\$1999

P5-120

- Intel 120MHz Pentium Processor
- 16MB EDO Performance DRAM
- 256K Pipelined Burst Cache
- 1.62GB 9ms EIDE Hard Drive
- 2MB DRAM, 64-Bit PCI Graphics Accelerator
- 6X EIDE CD-ROM Drive
- 3.5" Diskette Drive
- 15" .26dp Vivitron Color Monitor (14.0" viewable)
- 7-Bay Desktop Case
- 104* Keyboard & MS Mouse 2.0
- MS Windows 95
- MS Office 95, Professional Edition**
- Gateway Gold Service & Support

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P5-133

- Intel 133MHz Pentium Processor
- 16MB EDO Performance DRAM
- 256K Pipelined Burst Cache
- 1.62GB 9ms EIDE Hard Drive
- 2MB DRAM, 64-Bit PCI Graphics Accelerator
- 6X EIDE CD-ROM Drive
- 3.5" Diskette Drive
- 17" .28dp CrystalScan Color Monitor (16.2" viewable)
- 7-Bay Desktop Case
- 104* Keyboard & MS Mouse 2.0
- MS Windows 95
- MS Office 95, Professional Edition**
- Gateway Gold Service & Support

\$2949

Workstation Systems

G6-150

- Intel 150MHz Pentium Pro Processor
- 32MB DRAM
- 256K Internal Cache
- 2GB EIDE 9ms Hard Drive
- Matrox® 2MB WRAM Graphics Accelerator w/ MPEG Video Scaler
- 6X EIDE CD-ROM Drive
- 3.5" Diskette Drive
- 17" .26dp Vivitron Color Monitor (16.0" viewable)
- 12-Bay Tower Case
- 104* Keyboard & MS Mouse 2.0
- MS Windows NT™ Workstation 3.51
- MS Office 95, Professional Edition**
- Gateway Gold Service & Support

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G6-200

- Intel 200MHz Pentium Pro Processor
- 64MB DRAM
- 256K Internal Cache
- 2GB SCSI 9ms Hard Drive
- Adaptec 2940 PCI Ultra SCSI Controller
- Matrox 2MB WRAM Graphics Accelerator w/ MPEG Video Scaler
- 4X SCSI CD-ROM Drive
- 3.5" Diskette Drive
- 17" .26dp Vivitron Color Monitor (16.0" viewable)
- 12-Bay Tower Case
- 104* Keyboard & MS Mouse 2.0
- MS Windows NT Workstation 3.51
- MS Office 95, Professional Edition**
- Gateway Gold Service & Support

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** MS Office 95, Professional Edition includes Word, Excel, PowerPoint® presentation graphics program, Schedule+, Access database and Bookshelf® '95.

Gateway 2000 Manufacturing, North Sioux City, South Dakota, is ISO 9002 certified.

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Generations II SOFTWARE COLLECTION

- Microsoft Encarta® '96 ■ MS Cinemania® '96 ■ MS Julia Child: Home Cooking with Master Chefs ■ MS Bob,™ For Gateway 2000 ■ MS Works 95 ■ MS Publisher 95 ■ MS Money 4.0 ■ MS Golf ■ MS Music Central™ '96 ■ MS CD Sampler ■ MS Entertainment Packs 1-4 (31 fun games!) ■ Ca\$h Graf Home Office Plus™ ■ Mayo Clinic® Family Health Book ■ Mediamatics Arcade™ MPEG Player ■ The Masters®: Interactive Journey Through Its 60-Year History, for MPEG

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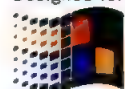
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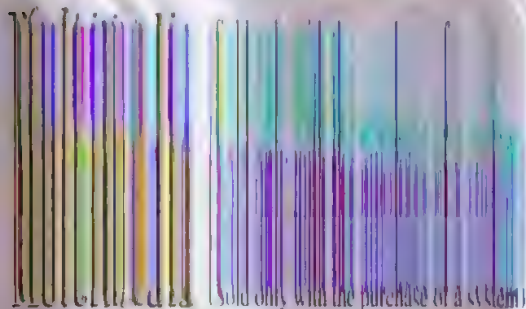


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Audio Multimedia Kits

Choose a Gateway 16-bit CD-quality sound card or an Ensoniq® Soundscape™ 16-bit wavetable sound card. Both Sound Blaster compatible and include two Altec ACS-40 speakers.

\$95 (Gateway 16-bit sound card and Altec ACS-40 speakers)

\$115 (Ensoniq Soundscape 16-bit wavetable and Altec ACS-40 speakers)

Multimedia Speaker Upgrades

Add the all-new ACS-250 subwoofer to provide up to 40 watts of additional bass.

\$75 (upgrade from systems which include Altec ACS-40 speakers)

The Dolby® Surround Sound ACS-400 speaker system will make your CD audio multimedia applications come alive with true theater-like surround sound.

Complete with two ACS-400 satellites and ACS-250 subwoofer.

\$120 (upgrade from systems which include Altec ACS-40 speakers)

6X EIDE CD-ROM Drive

This 6X EIDE CD-ROM drive provides 900KB/second data transfer rate and 214ms average access time and supports multisession photo CDs and XA format, enabling simultaneous audio and data with additional hardware.

\$60 (upgrade from systems with 4X CD-ROM drive)

4X Three-CD Changer

Enhance the value and usefulness of your PC with a 4X three-CD changer. You'll have access to three times the amount of information of a single CD-ROM drive.

\$100 (upgrade from systems with 4X CD-ROM drive)

Communications (Sold only with the purchase of a system)

TelePath® 28.8 Fax/Modem with TAD

Internal fax/modem, 28,800bps modem, V.34, with 28,800bps fax capability. Sends and receives data and faxes, and includes telephone answering device (TAD), full voice mail capabilities. Includes trial memberships to CompuServe®, AOL and Prodigy® and more! **\$149** (TelePath 14.4 Fax/Modem \$79)

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Gateway Vivitron™ Color Monitors

Non-interlaced color monitor using Sony® Trinitron® tube technology, capable of 1280 x 1024 resolution.

Gateway 15-Inch Vivitron Color Monitor, .26 dot pitch

Upgrade from a 14" CrystalScan® to 15" Vivitron monitor **\$160**

Upgrade from a 15" CrystalScan to 15" Vivitron monitor **\$75**

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Upgrade from a 15" CrystalScan to 17" Vivitron monitor **\$365**

Upgrade from a 15" Vivitron to 17" Vivitron monitor **\$290**

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3Com® Ethernet Adapters

High-performance 16-bit Ethernet cards.

16-bit Triple Media Card with BNC, AUI and RJ-45 connectors **\$99**

16-bit Card with only RJ-45 connector **\$79**

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Only available to our valued customers! Windows 95 will make your system faster and easier to use. Order your copy today! **\$79** (On diskettes \$89)

Finance Pack

Includes Quicken Deluxe 5; Quicken® Financial Planner™; Quicken Family Lawyer™; Quicken Parents' Guide To Money™; and a coupon to receive TurboTax® Deluxe upon release at no extra charge. **\$79**

10th Anniversary Software Bundle

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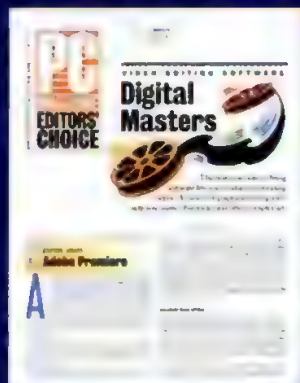
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Sibelius Academy Music Resources

If you've tired of the music scenes in Seattle and New York's East Village, the only place to turn is a Web server in Finland. The Sibelius Academy, a conservatory in Helsinki, provides a list of music sites that would rival a Vienna guidebook. It not only links you to jazz, blues, rock, and pop pages but covers famous composers, gospel, instruments, research, theory, and opera as well. The site's only graphic is a diminutive Finnish flag, but with such an array of music you don't need much else.

<http://www.siba.fi/Kulttuuripalvelut/music.html>

Sistine Chapel

Rumors that Vatican employees laid on their backs to code this page are unfounded, but the Cappella Sistina Web site still manages to capture the beauty of Michelangelo's greatest work. A master plan of the building's interior and a few historical paragraphs give way to a copious collection of high-resolution JPEG files. These images reproduce every inch of the chapel's painted surfaces, from the ceiling to the spandrels and lunettes to the altar wall.

<http://www.christusrex.org/www1/sistine/0-Tour.html>

Sony Music Online Many of the great artists of contemporary music are under contract at Sony: Bob Dylan, Bruce Springsteen, Eve's Plum. With the Sony Music Online site, you can access an enormous body of resources dealing with these performers and many, many other artists: sound clips, video files, photographs, tour information, music catalogs, and news. The Featured Artist section will even tell you which performers are currently hip and link you with detailed information on their latest albums.

<http://www.music.sony.com/Music/MusicIndex.html>

The Ultimate Band List

This site will make your hard disk churn like an old-fashioned ice cream maker on an August day, but once it's cached, your musical possibilities are endless. The Ultimate Band List provides Web pages, mailing lists, ftp sites, concert reviews, audio clips, newsgroups, guitar tablatures, and lyrics for more bands than anyone would ever care to count. Although you can download smaller sections of it according to genre or resource type, the master list is an incredible

993K. When you finally get to that Elvis ftp site, the wait will be justified.

<http://american.recording.com/wwwofmusic/ubl/ubl.shtml>

Web Museum, Paris

This gallery of the world's greatest artwork is not just a Web page; it's a movement. Over 35 sites across five continents serve up Web Museum to more than 100,000 visitors per week. Thus, if you're in the rain forests of Brazil, you will still have amazingly rapid access to all of Nicolas Pioch's digital exhibits, including Art of the Twentieth Century, Paul Cézanne, and Famous Paintings. The massive collection of images, short tour of Paris, and deep auditorium of classical audio files make Web Museum the quintessential Art and Music site. <http://sunsite.sut.ac.ip/wm>



Like the radio and the television before it, the Web has gradually evolved from an esoteric technology into a medium of the masses. Some of the Web's content has retained an educational and Apollonian stance, but many sites are awesomely trivial, flippant, and unruly. Gaudy high heel collections, virtual body-piercing games, and daily fish tank updates have found their way into cyberspace and are yours for the asking. So cancel your dinner reservations at the Four Seasons, let your date down easy, and spend the night surfing the Web for fun, laughter, and eccentricity.

The Electric Postcard

When it's your parents' anniversary and you can't make it to Tiffany's, send them a sweet, satisfying virtual greeting from The Electric Postcard. This MIT Media Lab site lets you choose a postcard from its eclectic collection, pair it with a personal message (complete with links and images), and address it to your favorite Web maven. Addressees receive an e-mail asking them to claim their gift at the postcard pickup window. Give it a try; everybody but the U.S. Postal Service is doing it.

<http://postcards.www.media.mit.edu/Postcards>

The Gigaplex

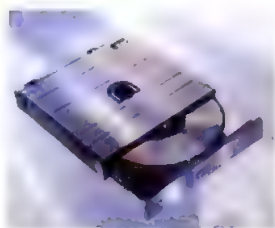
If you haven't yet realized that *-plex* is the suffix of the nineties, this tribute to the multimedia world of entertainment will drive the point home. Living up to its name, the Gigaplex links to a plethora of plexes: Filmplex, Bookplex, Musicplex, Theaterplex, Artplex, Golfplex, Photoplex, TVplex, Foodplex, Loveplex, and Yoga-plex, to name a few. Each area contains countless interviews, excerpts, graphics, essays, insights, news, audio files, and videos that will keep you more than occupied.

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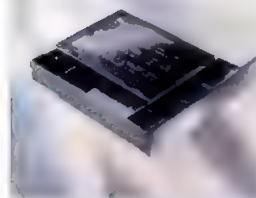
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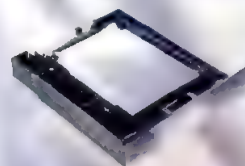
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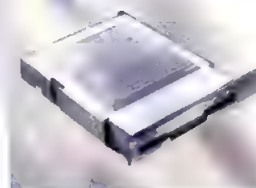
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Interesting Places for Kids

Until the day when preschool children are learning HTML before hitting the coloring books, this site is one of the best ways to guide your youngster through cyberspace. Interesting Places for Kids is a categorized list of fun, entertaining, and educational sites that Stephen R. Savitzky has compiled for his daughter, Katy. Links run the gamut of Web genres, from search tools to toys, music, films, and television. Be forewarned, however: Little Katy's Web pseudonym is Kathryn of Chaos.

<http://www.crc.ricoh.com/people/steve/kids.html>

MCA/Universal Cyberwalk

Since print ads, TV commercials, McDonald's tie-ins, and roadside billboards aren't enough, the major entertainment studios have now brought their enormous product promotions to the Web. MCA/Universal Cyberwalk, the pioneer of such sites, provides hype for each of its parent company's subsidiaries, including MCA Records, Universal Pictures, and Putnam Berkley Publishing. You can purchase videos, listen to audio files, read up on industry news, preview films, or check out Doc Brown's 1.21-gigawatt *Back to the Future* ride.

<http://www.mca.com>

Mediocre Site of the Day

For those who despise hyperbole, Jensen Harris's modest home page examines the middle ground between the Cool Site of the Day and Worst of the Web. The Mediocre Site of the Day lets you begin each morning with a new, strictly average Web page, then pore over the mass of flip-pant responses that it illicit. With such sites as "Cleaning Flood-Soiled Clothing," "Good Woodworking," and "The Guided Tour of Rammed Earth Tire Homes," you will never lack mediocrity again.

<http://patheon.cis.yale.edu/~jharris/mediocre.html>

Mirsky's Worst of the Web

If you are simply too average to see the humor in the Mediocre Site of the Day, this Mirsky-Style Productions page will boost your self-esteem with a journey through the Web's most pathetic sites. The infamous Worst of the Web icons, which are added almost daily, link to some amazingly painful examples of HTML coding, including "Endangered Feces" and "Nerds R Us." Should you begin to find merit in such sites, you may want to partake of the Mirsky Drunk Browsing Test.

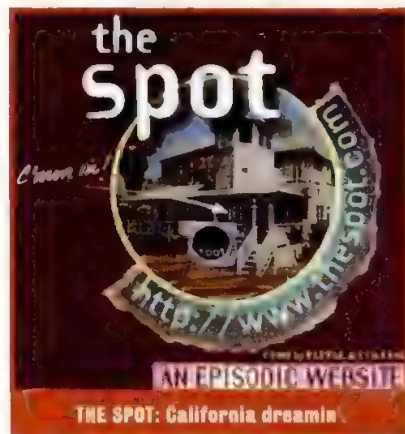
<http://mirsky.turnpike.net/wow/Worst.html>



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<http://Web3.starwave.com/showbiz>

The Spot After graduating from afternoon time slots to conquer prime-time television, the soap opera has now migrated to the Web. The Spot chronicles a group of young, restless, and beautiful



Californians who share a beach house and wear chic clothing. The housemates provides daily journal entries in which they relate their amazing adventures, complain about their unbearable hardships, and show off their bare midriffs. You can even interact with Michelle, Carrie, Lon, Tara, and Tomeiko by sending them fashion-conscious e-mail.

<http://www.thespot.com>

S.P.Q.R: The Virtual Rome

With its ionic columns, towering stone arches, and vestal virgins, CyberSites interactive Web game will bring you closer to ancient Rome than a college toga party. S.P.Q.R: The Virtual Rome lets you navigate the city's vivid, three-dimensional streets with the help of five wise and elusive characters. Getting used to the game

takes a while, but once you learn its intricacies you'll be gallivanting about the streets of Rome as if it were your backyard. Your task, of course, is to save the city from imminent destruction using nothing but a mouse and keyboard. Beware the Ides of March.

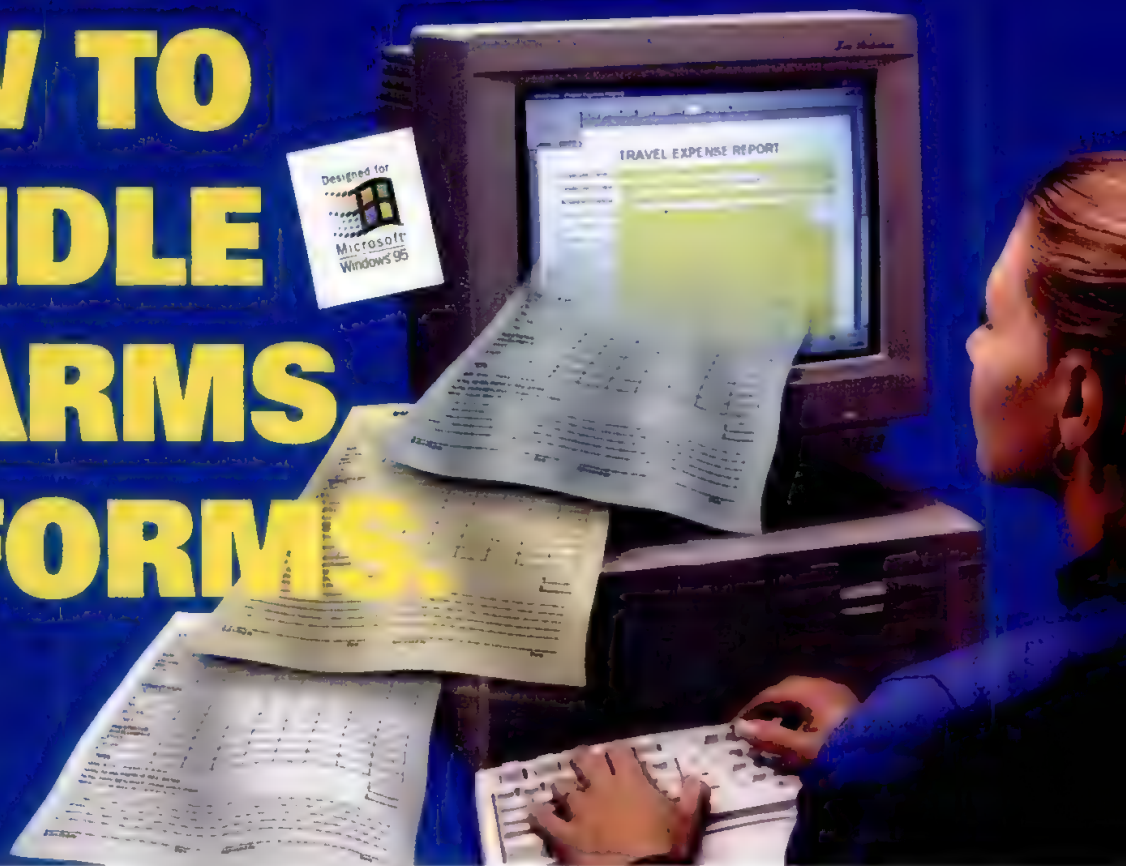
<http://www.pathfinder.com/@PhaM2uHPFgAAQJ18/twep/rome/>



The Squat If parody is the sincerest form of flattery, then the Squat exudes more adulation than a shelf of Hallmark cards. This deadpan rip-off of The Spot supplants the California beach-house crowd with "five hicks living in a trailer with a horse." Earl, Woody, Cleitus, Valvoline, and Larlene provide Spot-esque journal entries that stay away from bare midriffs and stick to fine backwoods English. Should you become well versed in Squatterese, you may want to consider Cleituss' invitation to move in and help pay the rent: "Yep, weese need-in' your all's hep!"

<http://theory.physics.missouri.edu/~georges/Josh/squat>

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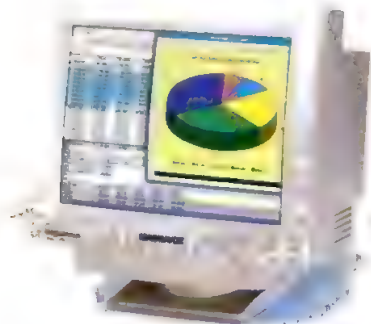
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CIRCLE 015 ON READER SERVICE CARD

the Death *of* Film?

Not quite. But a digital camera
is the better choice for
a range of jobs.

By Daniel Grotto & Sally Wiener Grotto

Remember the excitement of pulling apart your last Polaroid print, the misty, deep image appearing right before your eyes? Most of us are fans of instant gratification, and today's digital cameras provide just that. But unlike the mainstream Polaroid camera, the entry-level filmless cameras on the market today aren't targeted at casual snapshoters or hobbyists. At around \$1,000, prices are still too high, and image quality pales in comparison to print film.

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Instead, manufacturers are targeting business users. A digital camera provides a quick and easy means to capture images directly to a PC, and for many types of business applications, the convenience will outweigh the image-quality penalty. For instance, generating images for a presentation, newsletter, or Web home page is easier with a digital camera, since you won't need to take a photograph, have it developed, and then scan it into your PC. Law-enforcement personnel, insurance field agents, and building inspectors can use digital cameras to obtain a visual record of a scene. Real-estate agents can have photos of homes on-line in a PC database for prospective buyers to peruse. Security desks can use the camera to grab an instant image of everyone who enters a site. And so on. And with these types of high-use applications, digital photography quickly becomes much more cost-effective than film.

REVIEW CRITERIA

To be sure, there are a range of digital cameras out there, and the best ones can deliver photographs that rival top-of-the-line print-film cameras (see the sidebar "For Professionals' Eyes Only: Studio Cameras"). These units cost tens of thousands of dollars, though, and are aimed at professional studio photographers and photojournalists. For this, *PC Magazine's* first roundup of filmless cameras, we decided to look at the less expensive, entry-level devices designed primarily for business users and nonprofessional photographers. To qualify, a digital camera had to be targeted at the PC user and have a street price of less than \$1,000.

We received six cameras for review in this article—the Apple QuickTake 150, Casio QV-10, Chinon ES-3000, Dycam Digital Color Zoom Camera 10-C, Eastman Kodak Digital Science DC40 Camera, and Logitech FotoMan Pixtura. Prices range from \$739 for the QuickTake to \$1,095 for the ES-3000. Fuji announced its entry-level offering, the DS-220 as we prepared this story, but a final unit was not ready in time for testing. Also, Chinon preannounced the ES-1000, a 24-bit color filmless camera with a list price of under \$500.

SILICON VERSUS SILVER

Filmless cameras are very similar to traditional cameras. Both types have a lens,

shutter, and diaphragm. In fact, some professional-model filmless cameras incorporate off-the-shelf Nikon, Minolta, or Canon 35-mm camera bodies as a front end. The difference is the back end, or how the image is saved.

Traditional cameras focus their images on film coated with light-sensitive silver halide crystals. Later, in a darkroom or minilab, the film is immersed in a series of chemicals to develop and permanently fix the recorded image.

Filmless cameras focus their images on a stamp-sized photo-sensitive semi-conductor chip, called a CCD (*charge-coupled device*). In the PC's electronic world, the CCD acts as the substitute for film by turning the image it captures into *pixels*, or picture elements. CCDs are also used in scanners, fax machines, and camcorders, though the quality of most filmless camera CCDs is generally higher, and of course, more expensive.

CCDs contain hundreds of thousands or even millions of resistors, or sample points. The more CCD cells, the higher the resolution and image quality. When the shutter is opened, light striking the CCD cells creates electricity; the more light, the more juice. Where it's dark, no current is generated. To produce color, the image is passed through a sandwich of red, blue, and green filters. The light then falls on the CCD's pixels, which are either red-, blue-, or green-sensitive. The

DIGITAL CAMERAS

How to Read the Suitability to Task Boxes

The image quality you'll get from an entry-level digital camera isn't a match for print film, but for getting still images directly into a computer, using film cameras can't match the convenience of digital photography. The six digital cameras we looked at deliver that convenience with varying degrees of aplomb.

The **ergonomics and convenience** of a camera are very important, especially to those new to photography. We judged how familiar each digital camera would be to a typical buyer accustomed to point-and-shoot 35-mm film cameras. We also considered how comfortable the camera felt to the grip, how intuitive the status icons were to interpret, and how thorough the documentation was.

SUITABILITY TO TASK

Ergonomics and convenience	Poor
Capturing images	Fair
Uploading images	Good
Image quality	Excellent

To do well in our **capturing images** category, a camera had to be easy to use above all else. Are there automatic settings for exposure and shutter speed that shield the user from the complexities of f-stops? Can more experienced photographers set those parameters manually if they prefer? Better cameras also offered telephoto zoom and wide-angle capabilities, plus various flash modes.

Capturing an image is only half the battle; you also have

to **upload images** from the camera's memory to your PC. Here we evaluated how easy the included software was to install and use. We also considered how quickly images could be transferred to the PC. Once the images were there, we looked for robust image-manipulation and image-editing tools so the user could tweak a capture without necessarily opening the file in a more complex package such as Photoshop.

In the final analysis, **image quality** is everything. We took a hard look at various attributes that separate a good photographic image from a merely passable one. We evaluated dynamic range (the range between the brightest highlight and deepest shadows), color fidelity, and sharpness, as well as the quality of both screen images and printed output.

composite comprises a full-color image.

Those electrical states then must be averaged and translated into zeroes and ones by what is known as an analog-to-digital converter (ADC) chip. Digital cameras have built-in ADC circuitry that make the conversion the instant the image is captured. The digital data is then compressed and saved to the camera's memory. Depending upon the camera, the level of compression, and the type of storage medium, doing the ADC conversion and saving the image takes about 5 seconds. Wait an additional few seconds for the camera to recharge its built-in flash (if it has one), and you're ready to shoot another frame.

A second kind of filmless camera (not reviewed here) is a close cousin to the ubiquitous camcorder. *Still-video* cameras capture images the same way as digital cameras, but instead of immediately converting the images into digital data, they're instantly saved in analog form on miniature 2-inch floppy disks (the video equivalent of of audiotape). Later, the data on the disks is converted to digital information in an external ADC drive, or directly from the camera via a *video digitizer* (frame-grabber) board.

Video's primary advantage over digital is that images can be immediately displayed on a television set or computer monitor, or output to a VCR or broadcast feed. We didn't include any still video cameras because, at around \$2,500, even the least expensive model is a considerable price bump up from entry-level digital cameras. The Casio in this roundup, however, is a hybrid that features both digital and video capabilities.

THE PROMISE

Operating any of the cameras we reviewed is literally a snap, because they are all simple point-and-shoot devices that require no manual adjustments. Practically anyone can use one with only a few minutes' instruction. Uploading images to a PC is as easy as attaching a seri-

al cable connecting camera and computer, opening up the bundled software, and clicking on the command that automatically sends and saves the images to your hard disk.

Then there is the matter of speed. Instead of waiting hours or days to have your film processed and printed, simply

Dycam Digital Color Zoom Camera 10-C

None of the under-\$1,000 digital cameras we reviewed are good enough to replace a film camera for professional-quality images. But for capturing images to place on a Web page or in a newsletter, or for business

users such as insurance adjusters and real-estate agents, each of the six should prove at least adequate.

Dycam's Digital Color Zoom Camera 10-C (\$999 list and street), however, earns our Editors' Choice designation. It features point-and-shoot familiarity for those intimidated by photographic settings, and a host of user-selectable options for more advanced users. The Dycam offers three resolution levels, two zoom modes, three focus settings, and three flash settings. Images can be saved to its 1MB of memory or to plug-in PCMCIA memory cards. But what sets the Dycam apart—even from its physical twin, the Chinon ES-3000 (\$999 street)—is its image quality. Of all the cameras we reviewed, the Dycam was the only one that automatically sharpened images and corrected gamma during capture, which helped its images to stand out from the others.

Since it shares the same user-friendly yet extensible design, the ES-3000 does deserve an honorable mention, as do three of the other cameras in this roundup. The Kodak Digital Science DC40 Camera (\$850 street) produced

excellent images that were sometimes sharper and more detailed than those of the Dycam. We found, however, that the Kodak's metering system couldn't handle difficult lighting situations as well, which led to more wasted frames.



Also worthy of note is the Kodak's twin, Logitech's Foto-Man Pictura (\$900 street), which features an additional low-resolution mode that lets the camera hold up to 150 images, versus the Kodak's 96.

Another honorable mention goes to the Casio QV-10 (\$995 list). This tiny camera's host of features may make it right for a number of users, although we were disappointed with overall image quality—pictures tended to show artifacts and pixelization because of the unit's poor resolution. Still, its novel color LCD viewfinder/screen lets you review captured images instantaneously. Moreover, its digital-in/video-out capabilities will be of real interest to mobile business users. You can download a slide presentation or other images (up to 96 TIFF or .BMP captures) to the camera's memory, then hook it up to any video source (television, VCR, or video projector) and replay the slides.

snap a picture and immediately upload it to your laptop or desktop PC. With a modem and cellular phone, it's possible to instantly transmit images anywhere in the world, including the Internet.

THE SHORTCOMINGS

On the other hand, you would be wise to wait a while longer before throwing away your film cameras. Our test results indicate that, for all their advances and advantages, entry-level filmless cameras are dogged by various inherent practical limitations—chief of which is marginal

Our Contributors: DANIEL GROTTA and SALLY WIENER GROTTA, frequent contributors to *PC Magazine*, specialize in digital imaging and filmless photography and are the authors of *Digital Imaging for Visual Artists*. THOM O'CONNOR is a contributing photographer for *PC Magazine*. JAMIE M. BSALES was the editor in charge of this story, and PC Magazine Labs technical analyst DENIS TOM was the project leader.

How Filmless Cameras Work

PROCESSING-FREE PROCESS

In traditional film photography, a camera focuses an image on film coated with light-sensitive silver halide crystals. The film is then immersed in a series of chemicals to develop and permanently fix the image. In filmless (or digital) photography, the camera's lens focuses the image onto a light-sensitive chip called a CCD (charge-coupled device).

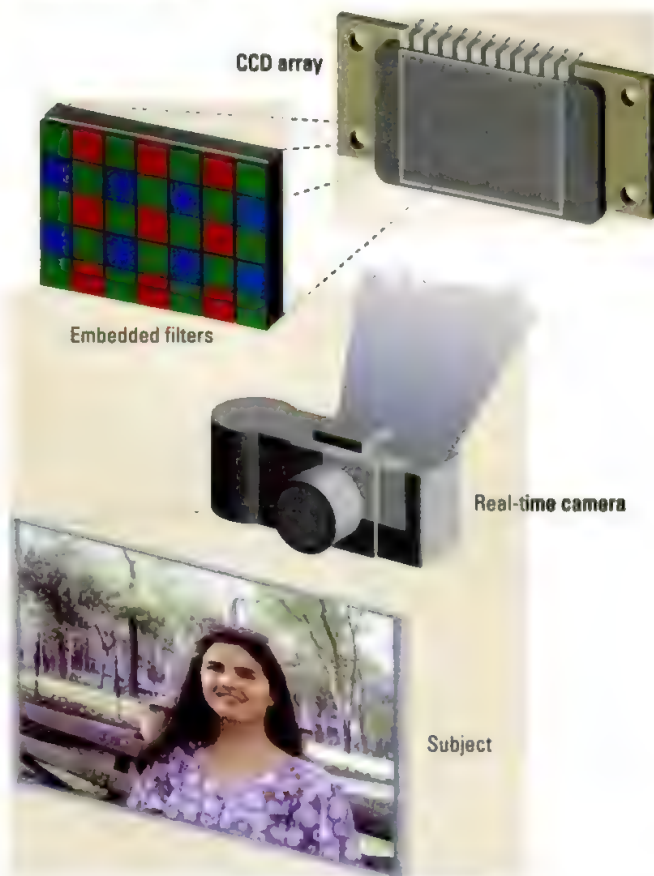
A CCD contains hundreds of thousands of resistors that act as sampling points to convert incoming light into pixels. Where light strikes, electricity is created. The intensity of the electrical charges is averaged and converted to binary 1s and 0s by an analog-to-digital converter chip. The digital data is then compressed and saved to the camera's memory.

ADVANTAGES

- You can capture images directly to digital format for use or storage on your PC, without having to bother having film developed and then scanning images.
- Uploading images to a PC is easy: Attach a serial cable to connect camera and computer, open up the bundled software, and click on the command that automatically sends and saves the images to your hard disk.
- With a modem and cellular phone, it's possible to transmit images instantly anywhere in the world or place them on the Internet.

DRAWBACKS

- At roughly \$750 to \$1,000, entry-level filmless cameras are presently too expensive for most casual shooters.
- Entry-level filmless cameras possess several inherent practical limitations, most notably marginal print quality. In our jury analysis, in fact, prints from a \$10 disposable box camera were judged far superior to the best images from the cameras we reviewed.
- If you enlarge the images beyond 3 by 4 inches, or 4 by 5 inches at 300 dpi, the prints will exhibit visible artifacts, pixelization, and a general lack of detail.



print quality because of their low resolution.

All six filmless cameras we tested are capable of producing 24-bit color, though they vary in resolution from 320-by-240 (for the Casio) to 640-by-480 (Apple, Chinon, and Dycam) to 756-by-504 (Kodak) to 756-by-512 (Logitech). On the Casio, users have the option of selecting either native 320-by-240 resolution or interpolated 540-by-480.

Those numbers are fine for VGA screen display, and generally acceptable when the pictures are printed no larger than 3 by 4 inches or 4 by 5 inches at 300 dpi. But enlarge the images beyond that point, and the prints will exhibit *artifacts* (stray marks caused by incorrect data points in the image) and *pixelization* (blocky patches and saw-tooth edges caused by the square pixels), plus a general lack of detail.

To put the image quality in a real-world perspective, our panel of nonexperts com-

pared the best dye sublimation prints produced from our six filmless cameras with snapshots taken by a \$10 Kodak FunSaver film-in-a-box camera and processed and printed by a 1-hour automated minilab. The results were unanimous: The box camera output was far superior to the best entry-level filmless camera.

Besides mediocre print quality, there are several other major deficiencies that may frustrate entry-level filmless camera users. One is the lack of control over image capture. Unlike comparably priced semiprofessional 35-mm film cameras, none of our six filmless cameras have the ability to manually set f-stops or shutter speeds to adjust for varying light conditions. The Kodak and Logitech (which are almost identical) allow users to select up to 1-stop exposure compensation, and the Casio allows up to 2-stop exposure compensation. None have interchangeable lenses, and, except for the Chinon and Dycam (which are essentially the

same camera with different software), with their autofocus 3X zoom lenses, all have fixed focus, fixed focal length lenses. In other words, the same lens system as a box camera.

Another weakness is the viewfinder system. Except for the Casio's novel through-the-lens color LCD screen, our other filmless cameras have simple optical viewfinders with no automatic parallax correction (which makes adjustments for accurately framing closeup and macro shots). That can mean that what you see in the viewfinder, especially at close distances, is not necessarily what you are capturing in the camera.

HIGH-END PLAYERS

Many of these shortcomings are addressed by the professional-caliber digital camera systems, such as the Kodak DCS-460 and Nikon E2 (discussed in the sidebar "High-End Studio Cameras"), which use standard 35-mm SLR camera bodies

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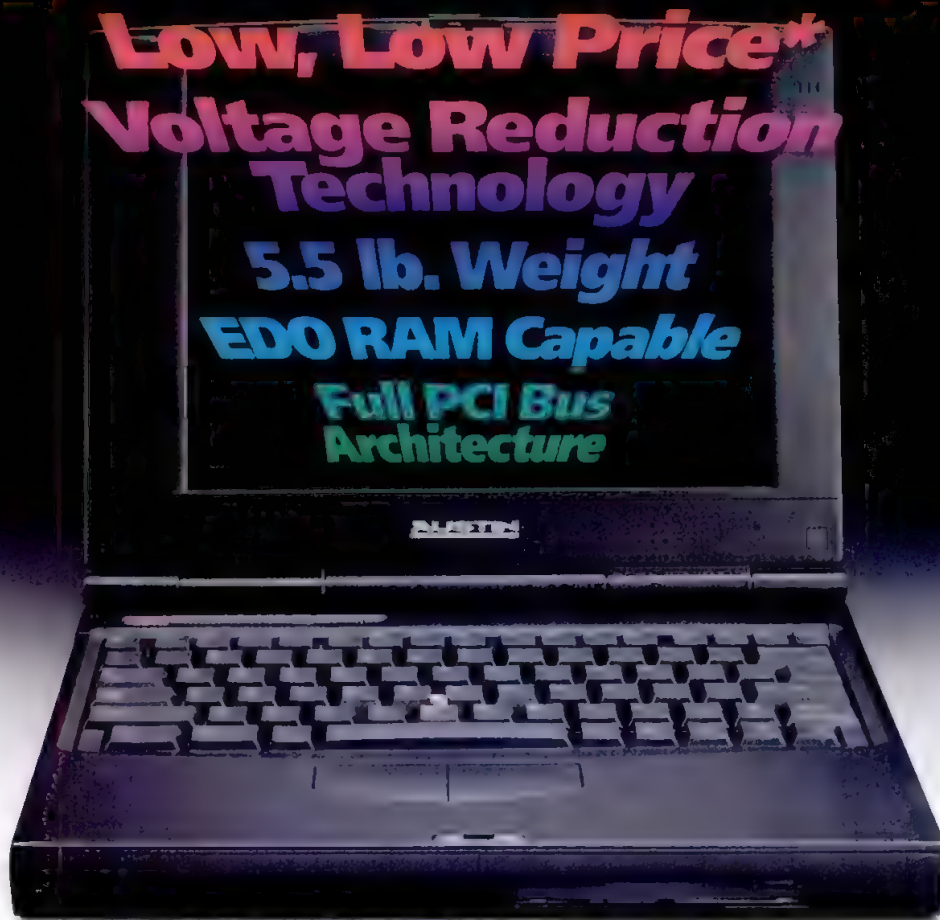
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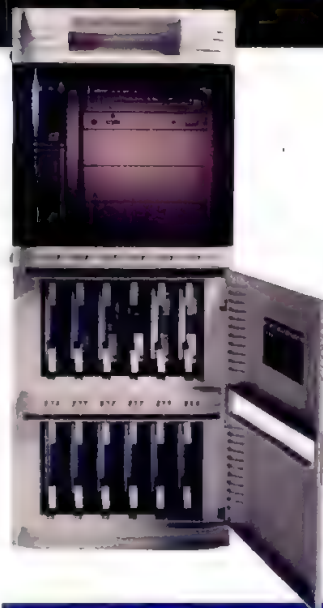
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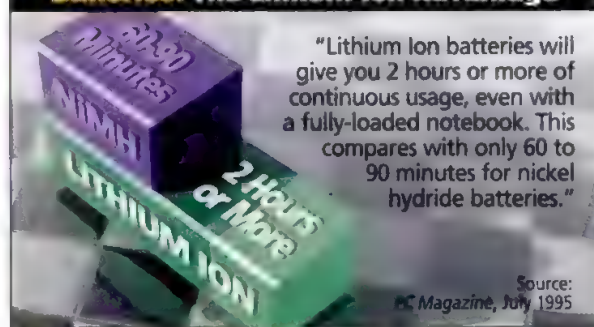
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as their front ends. These expensive players also use more complex designs than their entry-level counterparts, which helps them improve image quality. For example, the Minolta RD-175 and AGFA ActionCam (each priced around \$10,000) incorporate three moderately priced CCDs and a beam splitter to produce a 24-bit, 1,528-by-1,146 image, instead of shooting onto a single high-density CCD. Using three CCDs virtually eliminates color aliasing.

Even more specialized are the Nikon E2s and Fujix DS-515 (around \$16,500 each), which sport more internal memory. This gives them the ability to shoot in a burst mode of 3 frames per second for up to 7 frames, which makes them better suited for subjects that require fast capture, such as sporting events.

A FLASH OF A MEMORY

With conventional cameras, when you run out of film, you simply pop in another roll. Because our six filmless cameras save to built-in memory, you're far more limited in the number of total frames. In high-quality mode, the Chinon and Dycam can record only five images (though both cameras can accommodate optional, but expensive, 1MB to 16MB PC Cards); the Apple, 16 images; the Kodak and Logitech, 48 images; and the Casio, 96 images. Then you must offload the images to your PC and clear the camera's memory for more shots. Offloading the captures can take from 5 to 20 minutes, depending upon the camera, the computer's bps rate through the serial port, and what file format is being used. (Transferring compressed files in proprietary mode and expanding them outside the camera is much faster than simultaneously expanding, transferring and saving in formats like TIFF or .BMP.)

Except for the Casio, the filmless cameras we looked at do have the capability to increase the number of frames they can record by shooting in a lower resolution mode. That's somewhat of a misnomer, since (except for the Logitech) the resolution stays the same; it's the level of compression, and hence image quality, that changes. The Apple can capture a maximum of 32 standard-quality images; the Kodak, 96; the Logitech, 150;

and the Chinon and Dycam, 10 images in fine (medium) quality and 40 images in normal (low) quality on the built-in memory. The Apple, Chinon, and Dycam permit the user to switch to different modes from shot to shot, while the Kodak and Logitech's image-quality level must be reprogrammed from the computer.

Be warned, however: We found that the picture quality of medium- and low-resolution images is poor, and therefore unsatisfactory for most applications. Users will quickly learn to avoid all but the highest quality mode.



THE PROOF IS IN THE SHOOTING

All our cameras were very easy to set up and shoot, right out of the box. About the only problem was finding the right direction to insert the batteries. Similarly, installing the software was a straightforward process. While none were specifically Windows 95-compliant, all worked equally well under Windows 95 and Windows 3.11. Similarly, hooking up the serial cables and setting bps rates (up to 57 Kbps for the Casio, 115 Kbps for the others) were simple. However, we occasionally experienced camera freezes at 115 Kbps, which disappeared when we downshifted to a lower speed.

Taking pictures is, in most instances, just a matter of pointing and shooting. Because they feature more options, the Chinon and Dycam units require slightly more attention. Also, the Casio's video out and display capabilities mean memorizing what buttons or combinations of buttons trigger which functions.

A big difference between filmless and regular cameras is the several-second delay it takes for filmless cameras to capture an image, convert, compress, and save it as digital data.

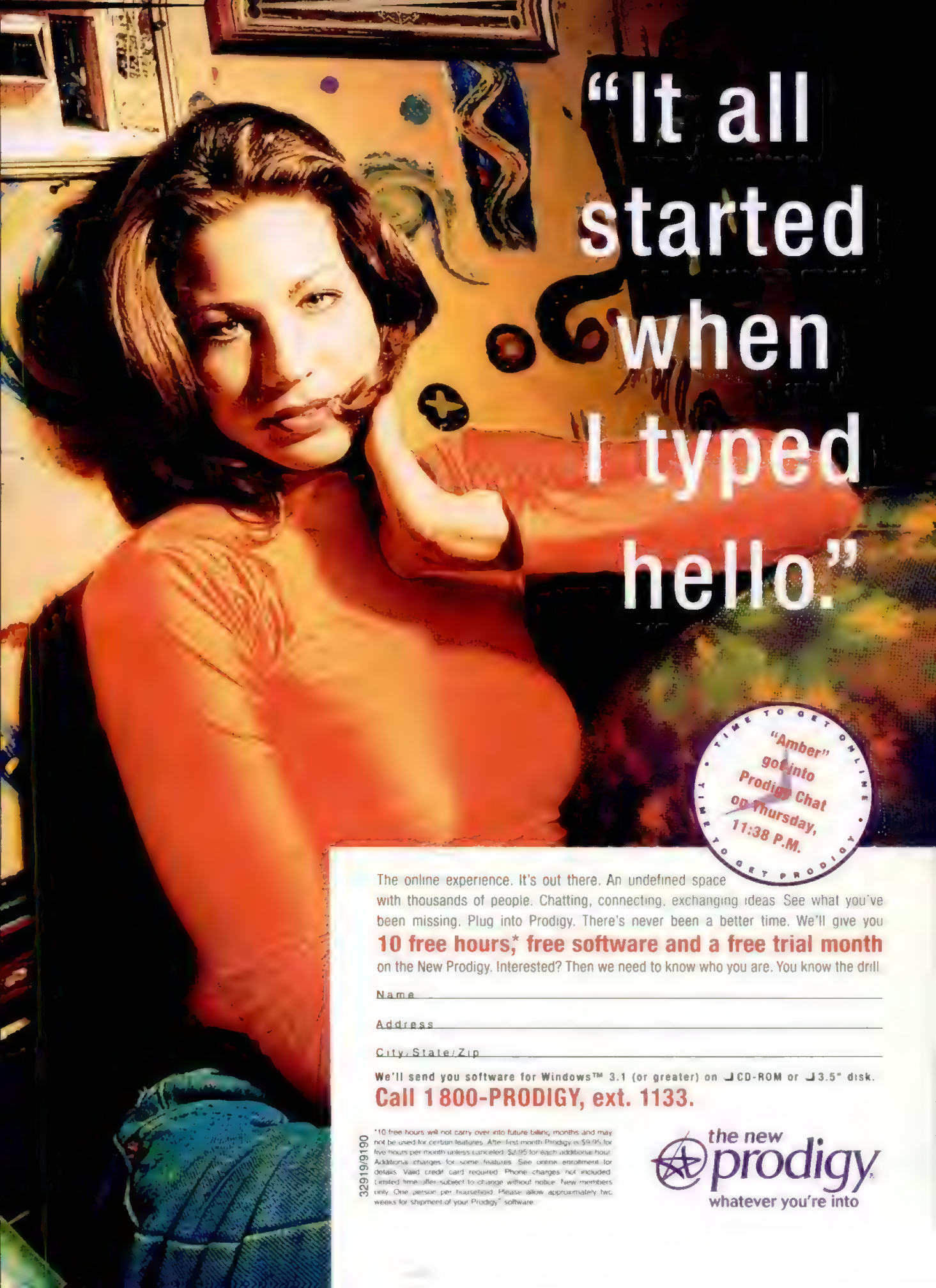
Unlike film cameras, each of these cameras lets you erase the most recent capture so you don't waste valuable memory on a botched shot. All but the Apple and the Kodak go a step further by letting you delete several nonsequential shots. All the cameras also offer a safety mechanism to prevent you from accidentally deleting images stored in the camera's memory. Another important feature is in the software included with the camera. Most include image-editing applets that let you crop, rotate, and tweak images without having to import them to a more intimidating image editor such as Adobe Photoshop.

IMAGE IS EVERYTHING

With its native capture resolution a paltry 320-by-240 (it can be interpolated up to 640-by-480 when images are saved as TIFF files), we were not surprised that the Casio produced the poorest print and screen quality. Our assembled jury panel unanimously concurred: The colors were muddy, and images were indistinct and severely pixilated, laced with streaks and other artifacts. As the only camera not equipped with a flash, the images shot indoors and in shadow simply lacked the snap that electronic illumination provides. Still, the Casio's innovative design may make it right for some users. Most notably, with its digital-in/video-out capabilities, you can download a business presentation to the unit's memory and replay it on a television set.

Because the Kodak and Logitech cameras produce the highest resolution, we had expected them to excel in image quality. However, except for one series of tests, they consistently trailed the Chinon and Dycam twins. Though the images were indeed sharper than the other cameras, they tended towards underexposure and the colors were less saturated and slightly muddy. Because they are practically identical to each other, we assumed that the Kodak and the Logitech should have produced the same quality images. But our panelists preferred the Kodak for better color, sharper images, and better illumination.

In 1994, the Apple was alone in the field of under-\$1,000 filmless cameras, and its QuickTake 100 garnered rave re-



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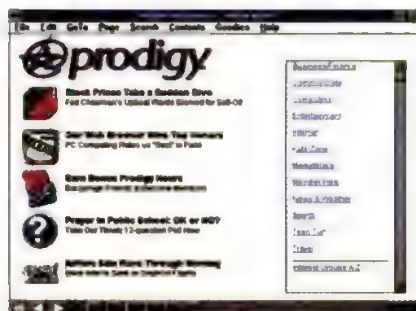
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For Professionals' Eyes Only: Studio Cameras

By Daniel Grotta, Sally Wiener Grotta,
and Thom O'Connor

Just as there's a day-and-night difference between a \$10 Kodak FunSaver camera and a \$10,000 Hasselblad 205TCC camera, there are substantial differences between entry-level filmless cameras and their much more expensive and sophisticated counterparts. While entry-level filmless cameras are simple point-and-shoot devices, midrange and high-end portable filmless cameras offer higher resolution, better optics, greater color depth, more control, faster shutter speeds, and a host of special features.

This translates into significantly better image quality for both print and electronic display: much more detail, greater dynamic range, and the ability to zoom in and magnify selected portions of a picture and retain image integrity.

Such devices don't come cheap, however. Street prices range between \$9,000 and \$29,000, and that doesn't include lenses, accessories, and of course, the cost of a suitably equipped PC. To get a feel for how well such units perform in a professional photo studio, we integrated two worthy representatives into our studio at *PC Magazine*: the Kodak DCS 460 (\$27,995) and the Nikon E2 (\$13,995 list).

The Nikon E2 (and its identical twin, the Fujix DS-505) is based on Nikon's flagship F4 SLR body. It's fat and heavy, but surprisingly well balanced and easy to shoot. It can, however, be difficult and intimidating to use because it has more controls and options than any other camera we've ever seen.

But that allows the camera to get the best possible image out of its maximum image resolution of 1,280-by-1,000 (uncompressed file size is 3.7MB). While it has no SCSI port like the other high-end studio cameras, it does include video-out capabilities for offloading images via a standard NTSC broadcast signal. It is also the only filmless camera with a secondary



Images from the professional-caliber Kodak DCS 460 (left) and Nikon E2 are good enough for newspapers and even magazines.

optical condenser lens that allows for full frame viewing, and retains 1:1 focal-length capability.

Thanks to the optical condenser, viewing through the bright, full-frame finder is crisp and precise. Automatic white balancing and an effective exposure speed of ISO 800 means the E2 is at home in the dimmest of available light.

In action, the E2 captures images quickly and accurately, much like any professional 35-mm film camera. Downloading the images to the E2's removable flash memory is quick and painless, as is uploading to a computer through Photoshop. Images are high enough in resolution and color accuracy to be reproduced in newspapers and corporate publications.

The only significant drawback to the E2 system is that the internal optical system, while providing bright, full-frame viewing, also limits the camera to an effective aperture of f/6.7. The photographer who routinely uses smaller apertures to increase front-to-back image sharpness will be stymied by the E2's aperture limitations.

The higher-end Kodak DCS 460 has no such limitation. Starting with a Nikon camera body, Kodak grafts on a rectangular tailpiece housing the digital electronics. As with the E2 system, the Kodak camera offers a complete panel of automatic and manual expo-

sure and focusing options, and makes use of the entire line of Nikkor lenses. The finder displays the full lens view, with a smaller black frame indicating the actual image-capture area.

The camera uses Kodak's top-of-the-line 6-megapixel CCD, capable of producing a resolution of 3,060-by-2,036 at 12 bits per color channel, for an uncompressed file size of 18 MB. That makes captured images a direct equivalent of 35-mm Kodachrome film. The tradeoff for this resolution is speed and sensitivity: It takes 12 seconds to process and save an image, and the ISO equivalence is a slow 100. Each raw image consumes 6MB of hard disk space.

In use, the DCS 460's bulk makes it a little hard to handle, and the slow exposure speed means additional lighting is necessary indoors. Images are recorded to a removable hard disk on a PC card. Downloading the large files through a card reader to a computer is teeth-grindingly slow process. But the images are worth the wait—very high resolution and accurate color, suitable for newspaper and magazine reproduction.

While the Nikon E2's fast handling and high sensitivity make it a great choice for news and corporate shooting, the Kodak DCS 460's near-film quality images peg it as a serious contender for magazine work.

Performance Tests: Digital Cameras

Regardless of how many bells and whistles a particular filmless camera may or may not have, at the end of the day what counts most is the image quality that device is capable of producing. Here's what we found.

How We Tested

To check out how well our six filmless cameras perform, we shot a series of pictures that a typical business user might want for a newsletter or Web page. These included a head shot, an executive portrait, a full-length body shot in an office environment, a desktop setup, and a macro product shot. We asked our model (actually staff editor Holly Aguirre) to wear a bright red jacket, because some CCDs have difficulty accurately capturing that color. Then we went outside to a nearby park and took portraits in a natural environment. For these outdoor shots, we asked the model to wear a pattern dress to check how each camera's CCD handles *noise*—alternating spots or stripes of light and dark.

We used a variety of camera settings, according to whatever features each unit

offered (save for the Casio QV-10, which has no flash): automatic flash, flash fill, and no flash; plus and minus exposure compensation; telephoto and wide-angle zoom; and all possible resolution or compression settings. (The images presented here were judged to be the best each camera produced.) To provide a control for comparing image quality, we shot the same scenes with a \$28,000 Kodak DCS-460 filmless camera and a \$325 Leica Mini 35-mm point-and-shoot camera loaded with Kodak Gold Ultra 400 print film.

WE THE JURY

To evaluate image quality, we enlisted 20 *PC Magazine* staffers and freelancers to rate the images on a scale from best to



Leica Mini 35-mm film camera.

worst. To maintain the best possible quality, we did not resize (interpolate) the images; interpolating the images would have forced the adding of pixels by an image editing package, which would have decreased image quality. Also, though some of the cameras' programs provided tools for tweaking color, gamma, and other attributes, we used default settings throughout.

We opened each image as a TIFF file in Photoshop 3.0.1 and printed it on a Tektronix Phaser 480 dye sublimation printer. We placed the unlabeled images on a viewing table, interspersed with prints from the Kodak DCS-460 filmless camera and the Leica Mini.

THE ENVELOPE, PLEASE

And the award goes to—the 35-mm film camera, the Leica Mini. No surprise here. Although digital photography has come a long way, images from the entry-level filmless cameras now on the market don't come close to print-film photographs. But our panelists had definite opinions on the merits (and demerits) of

THE DEATH OF FILM?

So will digital photography eventually replace film photography for shooting everything from magazine layouts to your summer vacation? Absolutely, but the key word is *eventually*. CCDs have a long way to go before they can generate high-resolution, continuous-tone images at a price for the masses. High-quality CCDs are difficult to manufacture, because so many resistors must be packed onto the chip. The CCDs resident in the high-end Kodak DCS-460 (covered here in a sidebar), for instance, reportedly cost

	Download time per image (seconds)	Recycle time without flash (seconds)	Recycle time with flash (seconds)	Photos per set of batteries
▼ Lower numbers represent better performance. ▲ Higher numbers represent better performance.	▼	▼	▼	▲
Apple QuickTake 150	9	5	8	182
Casio QV-10	8	6	N/A	774
Chinon ES-3000	48	10	10	490
Dycam Digital Color Zoom Camera 10-C	29	10	10	485
Kodak Digital Science DC40 Camera	14	4	5	846
Logitech FotoMan Pictura	20	5	5	867

N/A—Not applicable: This product does not include a flash.

views for its clear images. The 150 is a significant upgrade—more memory, macro capability, improved image-sharpening algorithms, better software, lower price. But when stacked up against the current crop of cameras, it doesn't seem quite as impressive. QuickTake images lack crisp detail; the flash doesn't carry much past 9 feet; and the colors, while bright and saturated, aren't always accurate.

The Chinon and Dycam both manage to combine a host of features with the best image quality in their class. We were impressed with their autofocus and 3X power

zoom, as well the ability to accept PCMCIA memory cards. But what we liked most were the clarity of the images: they were sharp, almost free of artifacts and noise; the colors were more accurate than our other cameras; and the exposure balance was excellent. Though the cameras are identical, the Dycam's images were consistently picked as the best of the lot, primarily due to the Dycam's superior software. Using default values, the Dycam's program applies an automatic gamma correction and a sharpen filter when the images are saved to the hard disk.



Apple QuickTake 150.



Casio QV-10.



Chinon ES-3000.



Dycam Digital Color Zoom Camera 10-G.



Kodak Digital Science DC40 Camera.



Logitech Fotoman Pixtura.

\$18,000 apiece. Better manufacturing methods and increased demand promise to push CCD prices down, but don't look to the current generation of filmless cameras as shining examples.

Since you won't want to tote a laptop around the Grand Canyon to offload images every two dozen shots, the memory capacity of digital cameras has to increase. More importantly, image quality has to improve immensely before casual users will be convinced to give up their \$100 point-and-shoot 35-mm film cameras or \$400 SLRs. (Note that when we

refer to "good" or "excellent" image quality in the reviews, we mean relative to other digital cameras, not film.)

But are digital cameras suitable for a host of business uses today? Absolutely. If you buy a digital camera expecting a suitable replacement for film prints, you will be disappointed. But if you're spending a lot of time and money on film processing for pictures you actually need on your PCs—and you can get away with good-enough image quality—the convenience of instant-gratification digital photography is waiting.

Apple Computer Inc.

Apple QuickTake 150

ALL REVIEWS BY DANIEL GROTTA AND SALLY WIENER GROTTA

At \$739 list (\$640 street), Apple's QuickTake 150 is the least expensive filmless camera we reviewed by almost \$200. Alas, with the low price comes fewer features and poorer image quality than some others. Still, the camera is easy to use and could serve as an entryway into digital photography for hobbyists and those whose needs are sat-



The blotchiness of this image shows the posterization effect apparent in some digital photographs.



The poor resolution of digital cameras compared to 35-mm film is obvious.

the six digital cameras we reviewed. Here are some opinions on the images we present on these pages.

Apple QuickTake 150. The capture is flat, lacking the proper contrast. The image is also softer than those from other units.

Casio QV-10. For screen display with no magnification, this picture is acceptable. But in printouts, pixelization is prominent. The colors also tended toward the blue end of the spectrum, and the lens created a barrel-type distortion.

Chinon ES-3000. Excellent. Color is saturated, if a bit contrasty. The skin tones are overly warm. Depth of field and background detail are both good.

Dycam Digital Color Zoom Cam-

era 10-C. Great accuracy of color, with subtle but correct skin tone. Excellent background detail and depth of field.

Kodak Digital Science DC40 Camera. A pleasant picture, though with little snap to it; could use more vitality of color or contrast. Still quite acceptable for screen display or a small printout.

Logitech FotoMan Pixtura. Slight exposure difference from its Kodak sibling, but the same overall pleasant balance. As with the Kodak, the image could use more snap.

THE WORST THAT CAN HAPPEN

In addition to the best images, we also present here two unacceptable images that are representative of what you may

encounter with digital photography.

Posterization. Posterization is a common problem in digital imaging. In this image, note the red of the jacket. It is a single, nongradient hue, without shadows or subtleties. The colors in the model's face are blotchy. The posterization could have been caused by the flash, which may have put more light onto the subject than the CCD could handle.

Poor resolution. At many of the cameras' low-resolution settings, there just aren't enough pixels to create a clear picture. The result is a blocky image, and subsequently much of the quality is lost. Tweaking in Adobe Photoshop would be required to produce usable images.

ified by passable digital pictures.

The QuickTake is as foolproof to set up and operate as a point-and-shoot automatic camera. Its CdS exposure meter automatically sets the optimum mix of f-stop and shutter speed (up to an ISO equivalent of 85 and a top speed of $1/175$ second). The control panel is easy to read, and most of the icons are self-explanatory. The camera has tiny buttons that you depress to select flash mode or activate the 10-second timer; users with large fingers may have difficulty pushing them. A better design feature is the recessed erase button, which requires the point of a pen or paper clip to depress to avoid accidental erasure of stored images. Unfortunately, there's no provision for deleting single images.

Powering the QuickTake requires three AA batteries. You can shoot a max-

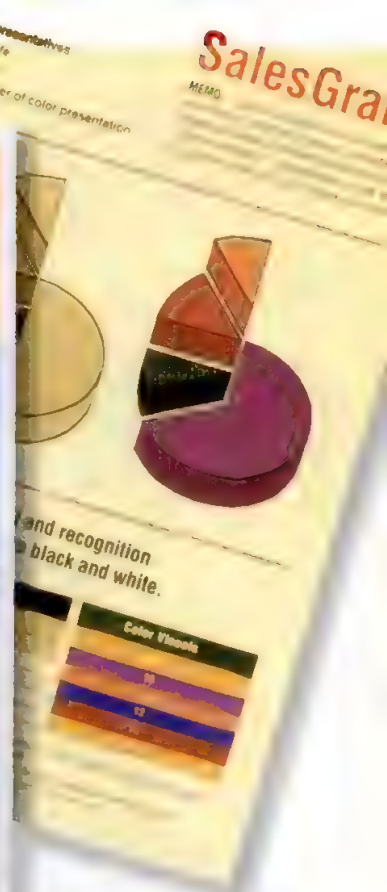
imum of about 180 high-quality images (half with flash) before replacing the batteries, which is far fewer than other cameras' capabilities. Apple does sell an eight-battery power pack for more staying power. We were also disappointed with the strength of the built-in flash, which carries a scant 9 feet.

For closeups (between 10 and 14 inches), the QuickTake uses an inexpensive—but surprisingly good—one-piece plastic snap-on macro lens. It incorporates a built-in split-image rangefinder that supposedly shows the user when the camera is within the focus range. But in practice, it is devilishly difficult to use. The only accurate method is to measure with a tape or ruler.

To keep the camera's price low, Apple has masked the QuickTake's CCD to reduce edge-to-edge resolution from a pos-

sible 768-by-512 to 640-by-480. That smaller area allows the QuickTake to get by with only 1MB of flash EPROM. The QuickTake lets you choose between different compression algorithms to store either 32 images in standard-quality mode or 16 images in high-quality mode. In both cases the resolution remains at 640-by-480; the more aggressive compression scheme has a tendency to introduce more artifacts, however. Most users will want to opt for the higher-quality mode.

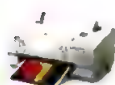
At 640-by-480, the QuickTake's CCD receives 20 percent less data than those in other cameras, and the quality of the images suffers. In our testing, we found that images looked somewhat flat and lacked contrast. Worse, the lower resolution lent a softness to images not seen with the Kodak and Logitech cameras



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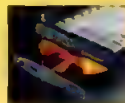
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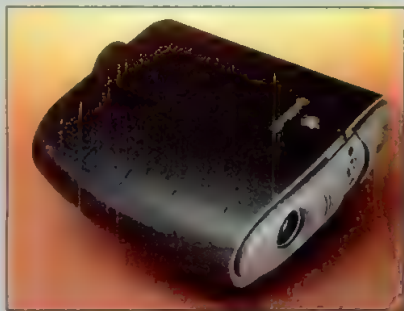
Digital Cameras



■ YES ■ NO

Products listed in alphabetical order

	Apple Computer Inc. Apple QuickTake 150	Casio Inc. Casio QV-10	Chinon America Inc. Chinon ES-3000	Dycam Inc. Digital Color Zoom Camera 10-C	Eastman Kodak Co. Kodak Digital Science DC40 Camera	Logitech Inc. FotoMan Pictura
List price	\$739	\$995	\$1,095	\$999	\$995	\$949
Dimensions (HWD, in inches)	2.2 x 5.3 x 6.1	2.6 x 5.12 x 1.57	2.4 x 4.1 x 5.8	2.4 x 4.1 x 5.8	2.2 x 5.3 x 6.1	2.2 x 5.3 x 6.1
Weight (ounces)	16.0	6.7	18.4	18.4	16.0	17.0
Macintosh interface	Optional (\$99)	■	■	Optional (\$149)	■	■
Photographic Specifications						
Type of viewfinder	Optical	LCD	Optical	Optical	Optical	Optical
Lens size (millimeters)	50	60	4-21	38-114	42	42
Interchangeable lenses	■	■	■	■	■	■
F-stop (maximum to minimum)	f/2.8-f/16	f/2-f/8	f/2.6-f/16	f/2.6-f/16	f/2.8-f/16	f/2.8-f/16
Focus	Fixed	Fixed	Automatic	Automatic	Fixed	Fixed
Exposure control	Automatic	Automatic	Automatic	Automatic	Automatic	Automatic
Exposure compensation	■	■	■	■	■	■
Shutter-speed control	Automatic	Automatic	Automatic	Automatic	Automatic	Automatic
ISO equivalency	85	100	200	200	84	84
Focusing range (inches)	48-infinity	7-infinity	20-infinity	19-infinity	5-infinity	5-infinity
Built-in flash	■	■	■	■	■	■
Self-timer	■	■	■	■	■	■
Capture Capability						
Type of capture	Digital	Digital or video	Digital	Digital	Digital	Digital
CCD size (diagonal, in millimeters)	8.5	5.1	12.7	12.7	12.7	12.7
Number of pixels	393,000	250,000	410,000	410,000	400,000	400,000
Resolution (minimum/maximum)	640 x 480 only	480 x 240 only	640 x 480, 320 x 240	640 x 480, 320 x 240	756 x 504 only	256 x 384, 768 x 512
Storage capacity and type	1MB flash SDRAM	2MB flash RAM	1MB flash RAM	1MB flash RAM	4MB flash RAM	4MB flash RAM
Number of images that can be stored:						
Highest image quality	16	96	5	5	48	48
Standard image quality	32	96	40	40	96	144
Color depth	24-bit	24-bit	24-bit	24-bit	24-bit	24-bit
Deleting images:						
Single frames	■	■	■	■	■	■
Selected frames	■	■	■	■	■	■
All frames	■	■	■	■	■	■
Frame protection	■	■	■	■	■	■
Battery type included	AA lithium	AA lithium	AA lithium	AA lithium	AA lithium	AA lithium
Can use standard alkaline batteries	■	■	■	■	■	■
Supplemental battery pack	■	■	■	■	■	■
Price of AC adapter	\$65.00	Included	\$69.00	\$79	\$58.95	\$75.00
Software and Support						
File formats supported	BMP, EPS, JPEG, PCX, Quicktake, TIFF	Proprietary software to convert to BMP, TIFF	BMP, TIFF, proprietary	BMP, .CMP, DCA, JPEG, .PCX, TIFF	Proprietary	BMP, JPEG, .PXN, TIFF
Image-manipulation functions	None	Crop, rotate	None	Crop, rotate, scale	Auto-exposure, color adjustment, dynamic range	Color adjustment, crop, rotate
Image-editing package included	PhotoNow!	Proprietary	Chinon Image Acquisition	Image Pals 2 Image Editor	PhotoEnhancer	PictureWorks, PhotoEnhancer
Photoshop-compliant plug-in	■	■ (Macintosh only)	■	■	■	■
Warranty (parts and labor)	1 year	1 year	1 year	1 year	1 year	6 months
Toll-free technical support	■	■	■	■	■	■
Technical-support hours (eastern time)	9:00-9:00 M-F	9:00-5:00 M-F	9:00-5:00 M-F	9:00-5:00 M-F	9:00-8:00 M-F	9:00-8:00 M-Th, 12:30-7:00 F
BBS	■	■	■	■	■	■
Web address	http://www.apple.com	http://www.casio.usa.com	http://www.chinon.com	None	http://www.kodak.com	None
Internet address	None	casitech@aol.com	Info not available	dycam@aol.com	datech@www.kodak.com	tech_support@logitech.com



► FACT FILE

Apple QuickTake 150

List price: \$739 **In short:** The easy-to-use Apple QuickTake 150 is presently the least expensive 24-bit filmless camera. Beginners may wish to start with this model for its ease of use; the control panel is easy to read, and most of the icons are self-explanatory. However, its features and image quality are barely competitive with other entry-level devices.

Apple Computer Inc., One Infinity Loop, Cupertino, CA 95014; 800-538-9696. Circle 449 on reader service card.

SUITABILITY TO TASK

Ergonomics and convenience Good

Capturing images Fair

Uploading images Excellent

Image quality Fair

that employ the same (though unmasked) CCD. And while the QuickTake's color is generally accurate and acceptable, we observed a tendency for flesh tones to posterize when illuminated with flash.

As with the Kodak and Logitech cameras we reviewed, Apple bundles a customized version of PictureWorks' PhotoEnhancer software for image capture and basic image manipulation. Also included is PhotoNow!, PictureWorks' Twain-compliant plug-in applet. PhotoEnhancer features a virtual control panel identical to that on the camera that allows the user to take shots from the computer.

PhotoEnhancer is intuitive and generally consistent in displaying thumbnails and performing automatic saves in a variety of formats. However, its editing and enhancing tools are minimal, and users will certainly want to export image files into a better program like Photoshop or Picture Publisher for final manipulation.

With its low price and foolproof simplicity, Apple's QuickTake will serve to introduce a lot of users to filmless photography. For serious business applications, though, you might want to opt for a unit that delivers better image quality.

Casio Inc.

Casio QV-10

The Casio QV-10 (\$995 list) sports an impressive list of features and capabilities. The ultraportable camera can store up to 96 frames before you need to download to a computer, it has an LCD as a viewfinder that doubles as a mini screen to play back the images

you've just captured, and battery life is excellent. You can even download slides from any presentation-software application to the camera and use the QV-10 on the road as your presentation device; simply hook it up to any television via the supplied cable. The only thing that keeps this unit from being the perfect filmless camera, in fact, is image quality. Its low-resolution pictures tend to show

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Max Resol.	1600 x 1200 @ up to 66Hz
On Screen Control	ScreenManager™ and ScreenManager™ Pro
Standards	MPR-II, TCO

T2-17TS	
Aperture Grill	0.25mm
Actual Viewing Diag.	16.0"
Scan Freq.	H:30-86kHz, V:55-160Hz
Res. Resol.	1280 x 1024 @ up to 82Hz
Max Resol.	1600 x 1200 @ up to 66Hz
On Screen Control	ScreenManager™ and ScreenManager™ Pro
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poor detail and a lot of pixelization.

At 6.7 ounces and a little larger than a cigarette pack, the QV-10 easily slip into a shirt pocket. The four AA batteries are good for up to 1 hour of continuous shooting, or about 750 images. Offloading every image (in the compressed mode) to a laptop or desktop PC takes less than 5 minutes. With a relatively fast f/2 fixed-focus lens, 100 ISO equivalence, and top shutter speed of $1/4000$ second, the QV-10 can shoot action subjects and keep camera shake to zero. Focal range is an impressive 5 inches (in macro mode) to infinity.

But the most novel feature is the QV-10's color LCD, which allows arms-length, through-the-lens viewing. The lens can also be pivoted 270 degrees, making the QV-10 an excellent camera for fast, one-handed shots that would otherwise be lost if the user had to take the time to properly frame a picture.

The QV-10 also features both digital and analog video output, so the images can be transferred to a computer, a VCR, a television screen, or a video projector. It is also the only filmless camera on the market that has digital input capability. A user can create an entire presentation of

business graphics—up to 96 images—and download them to the camera as TIFF or .BMP files for playback through the video-out port.

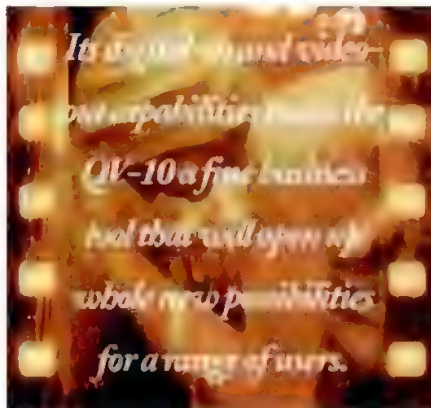
Functions are changed through a series of buttons on the top of the camera, and status and error messages are displayed in plain English on the LCD viewfinder. It's possible to flick through all the images and delete individual frames, or mark them for protection against accidental deletion.

While the QV-10's LCD viewfinder represents a welcome technological advance over a simple optical viewfinder, it still falls short of perfection. It can be practically impossible to see what's in the viewfinder when shooting a brightly backlit subject (despite the LCD's brightness control). It's also difficult in the macro mode to distinguish whether or not the subject is in focus.

Despite its impressive list of features, the QV-10 has only 2MB of built-in memory. That's only enough to apportion 25K to store each image. To produce a 24-bit image at 640-by-480 resolution, that file must then be uncompressed and interpolated up to 922K. Not surprisingly, the QV-10 images exhibited the highest degree of artifacting and pixelization. The colors are muddy except in bright light, and the images simply lack clarity and detail when output to

print. Screen output looks better, but only marginally so. Lack of a built-in flash was another drawback. Indoor shots lacked definition and detail, and the colors tended to take on a purplish overcast. To a degree, better exposure can be achieved by utilizing the QV-10's 2-stop exposure compensation capability.

With its digital-in and video-out capabilities, the QV-10 is a fine business tool that will open up whole new possibilities for a range of users. Real-estate agents, for example, can snap photos of available homes, then bring the camera to a buyer's house and present a video slideshow. To let the camera fulfill its full potential, though, Casio will have to add a flash and drastically improve image quality.



▶ FACT FILE

Casio QV-10

List price: \$995 **In short:** The Casio QV-10 features digital-in and video-out capabilities, which means you can create a presentation, download it to the camera, and play it back to any television. The most novel feature is the QV-10's color LCD, which allows instant viewing. But poor image quality mars this otherwise outstanding package.

Casio Inc., 570 Mount Pleasant Ave., Dover, NJ 07801, 201-361-5400 *Circle 450 on reader service card*

SUITABILITY TO TASK

Ergonomics and convenience	Excellent
Capturing images	Excellent
Uploading images	Good
Image quality	Poor

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Chinon America Inc.

Chinon ES-3000

Dycam, Inc.

**Digital Color Zoom
Camera 10-C**

There's a psychological advantage to using a device that resembles something familiar. That's why we especially liked the Chinon ES-3000 (\$1,095 list, \$999 street) and Dycam's Color Zoom Camera 10-C (\$999

list and street). These nearly identical units look, feel, and act like a point-and-shoot film camera. They feature auto-focus and a 3X push-button power zoom, and their ability to save images to a PCMCIA memory card that can be swapped in seconds is very similar to changing a roll of film. The Dycam unit comes with more sophisticated software than the Chinon, and the difference showed in output quality: Our jury consistently rated the Dycam's output as superior to its sibling's.

While there's no pre-flash capability (for eliminating "red eye" when shooting people), sliding a front panel to turn the cameras on will position the flash a little farther from the lens, which supplies better illumination. They also feature a green light that goes on in the viewfinder while the camera is compressing and saving, so you know when it's clear to shoot again.

Because of the position of the zoom buttons, you'll need to hold the cameras with both hands. Changing batteries can be tricky; you must first remove the strap, take off the outer flap, pry open an inner flap, put in the batteries, and then reverse the process. The control panel is easy to understand and, with three fingertip-size buttons, easy to program. These cameras give you more mode choices than most film cameras. You can select from three quality modes (normal, fine, and super-fine), two zoom modes (manual and program), three focus modes (multi autofocus, spot autofocus, and macro), and three flash modes (automatic, fill, and off). You also tell the cameras whether you're saving to built-in memory or a plug-in card.

The Chinon and Dycam models have f/2.8 lenses and a top shutter speed of



$1/500$ second. That, combined with a CCD sensitivity equivalent to 200 ISO, is fast enough to eliminate shakes while shooting in available light. The viewfinders automatically zoom to match the lens zoom; however, there isn't any frame of reference that tells you whether the lens is set at normal, telephoto, or wide angle. Etched inside the viewfinders are several dark lines that are supposed to guide you when shooting at close focus or in the macro mode. What lines are used in which mode can be confusing, and in low light, it's very difficult to see the lines at all.

Although resolution is always 640-by-480, in the superfine mode the cameras use a lossless compression algorithm that does not degrade image quality. The tradeoff is storage capacity: with 1MB, the cameras can hold a maximum of only five images in superfine mode. Optional

2MB to 16MB PCMCIA memory cards are available, but they use a proprietary format that cannot be read by a standard PCMCIA drive; you have to download images from the camera to your PC via the serial port, using the provided cable.

While the cameras have no exposure compensation provision, they do perform an automatic white balance, which helps improve both contrast and color.

Of the six filmless cameras we reviewed, the Dycam's software is the most sophisticated and incorporates the most features, including a histogram, eight file-format options, and a color palette. This allows for more quality control: You can see how your editing changes the dynamic range. And in the default mode, it was the only program that automatically sharpened and corrected gamma while acquiring images.

This is probably why our jury members consistently picked the Dycam's printed and on-screen images over the Chinon's. Both cameras produced vibrant, accurate color, good detail, excellent exposure, and minimal noise. The Dycam was a little more accurate in reproducing skin tones, however, and showed better background detail than the Chinon.

Either camera would be ideal for business professionals looking to capture images digitally. With the price being equal, though, the Dycam's better image quality gives it a slight edge.

▶ FACT FILE**Chinon ES-3000**

List price: \$1,095 **In short:** These nearly identical units act like familiar point-and-shoot SLR cameras. Images can be saved to proprietary PC Cards that can be swapped in seconds, much like changing a roll of film. Capture quality is very good. Both units feature auto-focus and a 3X push-button power zoom.

Chinon America Inc.,
615 Hawaii Ave.,
Torrance, CA 90503;
800-441-0222 *Circle*
451 on reader service
card

**Dycam Digital Color Zoom
Camera 10-C**

List price: \$999 **In short:** In superfine mode, the Dycam and Chinon cameras can hold only five images, you'll probably need to buy the optional PC Cards. The more sophisticated software of the Dycam gives it a slight edge over the Chinon. And our jury consistently rated the Dycam's output as superior to that of the Chinon.

Dycam Inc., 9414 Eton
Ave., Chatsworth, CA
91311; 800-883-9226.
Circle 452 on reader
service card

SUITABILITY TO TASK

Ergonomics and convenience	Fair
Capturing images	Good
Uploading images	Fair
Image quality	Good

SUITABILITY TO TASK

Ergonomics and convenience	Fair
Capturing images	Good
Uploading images	Excellent
Image quality	Excellent

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named Stan Shih set out to
create a billion-dollar **GLOBAL**
COMPUTER COMPANY with
a donation from his **MOM**.



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1976

With the aid of a maternal contribution and a total of \$25,000, Stan Shih founds Acer® as Multitech International and begins his dream for a microprocessing enterprise.

Stout first brother upholds the dignity of his brother's Presidential status by licensing his name to a beer company.

1977

During an interview, Stan Shih tells prospective employee William Lu the company may go bankrupt. 18 years later, Lu is president of Acer Computer International, managing millions in global business.

Who could possibly play a thin-as-a-rail droid in the most successful science fiction film ever? The 90-pound British actor who was thin-as-a-rail enough to fit inside his armor.

1977

Acer America Corporation is established by Stan Shih for manufacturing, assembling, marketing, and selling microprocessor-driven technology throughout North America.

Charlie's Angels tops Nielsen ratings, proving that six-foot blondes with feathered hair are the archetypal detective heroes of the seventies.

1976

When everyone else sees typewriters as the core of productivity, Taiwanese entrepreneur Stan Shih envisions the microprocessor as the engine of business.

After keeping a low profile for 3,300 years in an Egyptian tomb, King Tut flaunts his wealth across America in an extravagant seven-city tour.

Jet-setting Europeans break the sound barrier at 30,000 feet on the Concorde's first commercial flight from Paris to London.

Prank-happy, beer-swilling fraternity failures reach celebrity status when National Lampoon's Animal House debuts on big screen.

Acer assumes leadership role as high-tech gurus by opening a microprocessing center and training 3,000 engineers for Taiwan's information industry.

1978

Human egg is fertilized outside female womb and world's first test tube baby is born. And your thought hospitals were sterile.

To promote computer literacy in Taiwan, Acer publishes Microprocessor Bulletin and establishes credibility in microprocessing savvy.

Multitech International begins incorporating microprocessors into electronic games and taps into rapidly growing consumer technology market.

1977

The King of Rock and Roll dies and is born again in cheesy Vegas lounges where desperate actors don the jumpsuit and sideburns to eke out a living.

Stan Shih's dignified business partner and wife Carolyn Yeh scrubs office floors and schleps around Taipei on a scooter distributing Acer bills.

1979

Headband-sporting tennis prima donna trademarks his million-dollar recipe for success with racket-throwing fits and prolonged swearing-at-the-umpire outbursts.

Acer introduces Chinese language CRT terminal and subsequently receives Taiwan's most prestigious design award.

1980

Millions show concern for a ruthless oil snake who destroys lives for pleasure when they tune in to watch the "Who Shot J.R." episode of Dallas.

Juggernaut Russian Ice Hockey team slips up to a bunch of college boys from the United States at the Lake Placid Winter Olympics.

Acer starts mass-producing micro-processor-driven computer components for local manufacturers and begins exporting CRT terminals in bulk.

1980

Who would have thought a company could be so far ahead of its time?

Yet even in the age of the information superhighway, Acer continues to pave the road.



To meet the demands of tomorrow, PC technology must be more advanced, accessible, and flexible than ever. That's why we deliver cutting-edge PC systems and components around the world. Acer always delivers the freshest technology—because all our global factories are located in key technology markets. Our research and development center in San Jose, California, has been setting the pace for years. They developed the first RISC-based PC, the first symmetric multiprocessing server, and the first 64-bit architecture for Windows NT.



It's incredible what our new products can do!



Since Acer components and systems are modular, you can always expand your capabilities while protecting your investment. Even quality is never an issue. We originally manufacture all our own hardware from the ground up. And every Acer factory has met the strictest ISO-9000 standards. Our forward-thinking philosophy has catapulted us into the top ten echelon of PC companies. Today we're a four billion-dollar business with a formidable presence in 37 countries. So we can actually afford to hire a janitor to scrub our office floors.

If all this is making you shake your head in disbelief, wait until you read our next installment, 1981-1985

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"Its bright, spacious screen
makes the most of Windows 95."
-Computer Shopper, 12/95



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Business Leasing Available



Acer



Eastman Kodak Co.

Kodak Digital Science DC40 Camera

Logitech Inc.

FotoMan Pictura

While no match for Kodak's high-end DCS series of pro cameras, the Kodak Digital Science Camera DC40 (\$995 list, \$850 street) and Logitech's FotoMan Pictura (\$949 list, \$900 street) are impressive pieces of technology in their own rights. They are user-friendly and can produce fine images for entry-level digital cameras. With a lower street price and better warranty, the Kodak camera may be a better bet.

Engineered by Kodak but manufactured by each firm separately (using Kodak parts), these units are almost identical. Like the Apple QuickTake, these cameras have an ISO of 85 and a top shutter speed of 1/175. With a relatively fast f/2.8 lens and an aperture-priority bias, they can take low-light, non-flash shots that (after tweaking in Adobe Photoshop) produce usable images. Four AA batteries and a built-in flash pump out enough lumens to reach 12 feet. We were able to shoot almost 850 shots (half with flash, half without) on a single set of alkalines. The self-timer can be set for 10 or 20 seconds.

While there's no provision for selective deletion of captured images, you can choose between deleting all images or erasing just the last image. In addition, these cameras allow for up to 1-stop plus or minus exposure compensation, which helps fine-tune overall image brightness or darkness according to your prior shooting experience.

The units sport a 37-mm screw thread in front of the lens, for attaching auxiliary telephoto, wide angle, and macro lenses. Rubber pads cover part of the top and bottom of the case for a more positive grip. The well-positioned wrist strap makes shooting more comfortable and less prone to shakes. The control panel on the cameras is busy but not cluttered, and the icons are easy to understand.

Unfortunately, changing the image-quality setting and the count up/count down frame number can be done only in software. The cameras' default high-

quality setting accommodates 48 images; you must attach the unit to the computer to change to 96 low-quality images, or vice versa. Another oddity is the slight hesitation between when you depress the button and when the photo is actually taken. While it is just a fraction of a second, it takes getting used to. On the plus side, a red light shows in the viewfinder while the image is being converted and saved, and the cameras sound a reassuring beep when ready to shoot again.

With a resolution of 756-by-504 for the DC40 and 756-by-512 for the Pictura, these units offer the highest resolution among the filmless cameras we reviewed. To accommodate the larger file sizes, they come with 4MB of built-in memory. Uncompressed and saved as TIFF files, each image expands to 1.1 megabytes. That extra amount of information is what Kodak refers to as "digital depth."

That depth makes a difference: Our test images displayed at screen resolution were clear and sharp, especially on larger 17-inch and even 20-inch monitors. For prints, we had expected these higher-resolution entries to produce the most detailed images and the best color. Most prints were satisfactory; a few were good. While the images were sharper and slightly more detailed than those from the Chinon/Dycam duo, the single-mode metering system of the Kodak/Logitech

units couldn't respond as well to difficult lighting situations. This translated into more washouts (overexposure) and muddiness (underexposure).

The differences between the Kodak and Logitech units are few but important. One is the Pictura's low-resolution mode, which can capture 150 images at a resolution of 384-by-256. The Kodak's low-quality mode captures only 96 images, but at 756-by-504. In addition, we found that Kodak's proprietary algorithms produce fewer artifacts and generally more detail.

Another difference is what's included in the box. While Kodak documentation lacks technical detail, it's effusive when compared to the Logitech's single, sparse foldout sheet. Kodak includes an AC adapter; it's a \$75 with the Logitech. The third difference is the warranty. The DC40's runs for a year and covers everything, while the Pictura's is a parsimonious six months, with the flash tube guaranteed for only 2,000 flashes.

Both cameras excelled in this group at delivering good images for this class of camera. While their resolution could not be beat, in some instances the competing Chinon and Dycam models surpassed these units in overall image quality. Still, either the Kodak or Logitech is a fine choice. With a lower street price and longer warranty, the Kodak represents the better value. □

▶ FACT FILE

Kodak Digital Science DC40 Camera

List price: \$995 **In short:** With the highest resolutions of all the cameras reviewed, these two units produced fine images. To accommodate the larger file sizes, they come with 4MB of built-in memory. Kodak offers a better warranty, and its camera can be found for less money on the street than the Logitech.

Eastman Kodak Co.,
Digital & Applied Imaging,
901 Elmgrove Rd.,
Rochester, NY 14653, 800-
235-6325 *Circle 453 on*
reader service card



SUITABILITY TO TASK

Ergonomics and convenience	Good
Capturing images	Good
Uploading images	Excellent
Image quality	Good

FotoMan Pictura

List price: \$949 **In short:** The differences between the Kodak and Logitech units are few but essential. One is the FotoMan Pictura's low-resolution mode, which can capture 150 images at a resolution of 384-by-256. The Kodak's low-quality mode captures only 96 images, but at full 756-by-504 resolution. In addition, Kodak's proprietary algorithms produce fewer artifacts and generally more detail.

Logitech Inc., 6505
Kaiser Dr., Fremont, CA
94555, 800-231-7717.
Circle 454 on reader
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BUSINESS GRAPHICS

Draw Your Own Conclusions

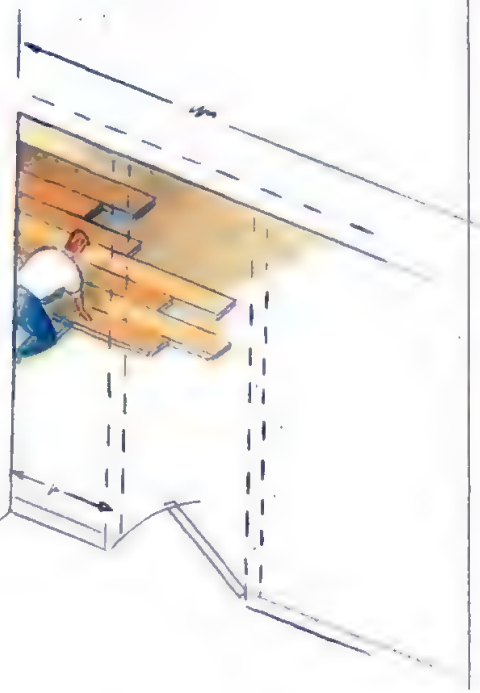


These diagramming and charting applications can help you turn your data into storytelling, information-filled images.

By Lance Ulanoff

Don't let the title fool you. This isn't a story for artists. It's for any graphics-impaired PC user who is forced to serve up attractive bar charts, diagrams, and schematics at a moment's notice. Whether you can distinguish a line width from a color palette makes no difference. All you need is programs that can easily create business graphics to convey information in an illustrative way.

These days, you don't have to hire outsiders to create visual wonders for you. Instead, you can turn to a myriad of programs created specifically to build business graphics. We realize that many of you need to produce both charts *and* various diagrams. That's why we've chosen for the first time to evaluate charting tools and diagramming pack-



ages in one two-part story.

Diagramming and charting applications aren't new to the PC market. They have a long and successful history, dating back to products such as Visi Trend/Plot (an add-on to the then-popular VisiCalc) and Micrografx In*a*vision. In the early 1980s, graphing was usually a feature of or add-on module to some of the more popular spreadsheets. Products like VisiCalc and Lotus 1-2-3 spawned a virtual industry of graphing add-ons. Diagramming and, in particular, flowcharting didn't really catch on in the mainstream until the release of ABC FlowCharter. And no one product may have helped us discard our stencils faster than the first version of Visio, from Shapeware (now Visio Corp.).

The hallmark of any of these tools, though, is ease of use. No matter how

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complex the diagram or chart, from electrical schematics to surface charts, none of these applications force you to *create*

such art elements as the symbol for a grounded wire or a sofa for a floor plan. Each application leads you through the process with wizards or robust templates.

CHARTS, PARTS, AND SMARTS

This is the first time we included the three major spreadsheets in an evaluation of business charting programs. We did so to answer the question, "Do I need more charting power than what already exists in my spreadsheet?" Without giving too much away, the short answer is probably yes. Of course, no charting tool reviewed here can match the calculating prowess of the three spreadsheet products.

If you ask people for the names of their favorite flowcharting programs,

HIGHLIGHTS

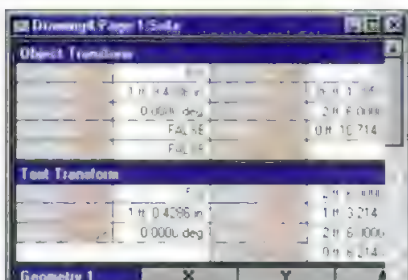
Business Graphics Tools

All these products will help you create business graphics, but they each have unique features worth noting.

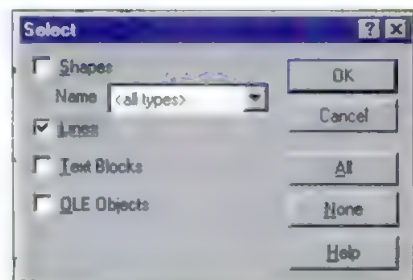
DIAGRAMMING



CLARIS IMPACT features highly automated flowchart shapes that sprout tools to let you drag a connector or shape in any direction.

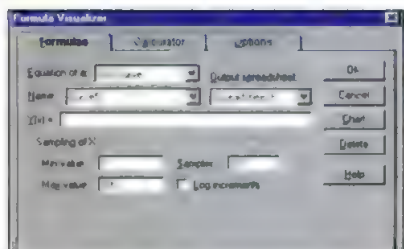


FINE CONTROL OVER OBJECTS is available through Visio's spreadsheet-style view of diagrams and shapes.



IN NO OTHER PRODUCT can you select and edit all shapes with the same name as you can do in ABC FlowCharter through its Edit/Select menu.

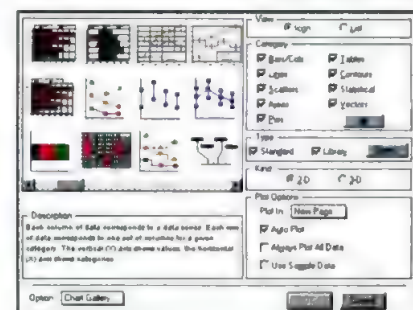
CHARTING



YOU CAN BUILD YOUR CHART based on a complex equation if you use Harvard ChartXL's intelligent Formula Visualizer.



NO OTHER CHARTING TOOL lets you choose and apply color schemes (like "Autumn") as easily as Quattro Pro's Graph Gallery.



DELTAGRAPH'S CHART GALLERY is almost unrivaled in breadth of charts and depth of associated information.

General purpose diagramming:

Visio

Charting:

Harvard ChartXL

In the workplace, the task of creating business graphics usually falls to a nonartist—a person who needs intelligent tools, feature-rich templates, and lots of hand-holding. Our two Editors' choice products—Visio Corp.'s Visio and

Software Publishing Corp.'s Harvard ChartXL—handily fulfill all those needs.

Few general-purpose tools are as versatile as Visio. It can help you create flowcharts, schematics, organizational charts, maps, and simple drawings with equal aplomb. No other product matches Visio's variety of diagram shapes and types, and the degree to which you can control and modify Visio elements is staggering.

The controls include a toolkit of commands for alignment, annotation, formatting, and individual selection of shapes or lines, as well as tools for reading and modifying shapes and importing and exporting data. And Visio supplies automated wizards to lead you through the creation of a host of diagram types.

Visio can also link information to individual objects, which comes in handy when you're building an org chart, or a map that must be kept current with details about various buildings and street fixtures. Visio's OLE services provide even more extensibility.

you'll most likely hear references to one of the *diagramming* tools reviewed here. That's not all that surprising, as many people use these tools primarily to build flowcharts and organizational charts. Even so, enhanced tools, templates, and better automation have expanded the scope of these products considerably. No longer do you need a CAD package to build a simple floor plan or electrical schematic. And the same tools that came in so handy when building your latest

flowchart make the job of building these other types of diagrams just as easy.

Some people have even begun to create simple maps and street plans with these applications' increased intelligence and usability. Most of the diagramming tools reviewed here in this roundup can link data to objects—a desk's height and width, an employee's salary or date of hire, or a photograph, for example.

Last year (in "Life Imitates Chart," May 30, 1995), we awarded ABC FlowCharter 4.0 an Editors' Choice award for flowcharting. As part of ABC Graphics Suite's current incarnation, ABC FlowCharter remains the best choice for flow charting. It even features automatic intersection bumps, essential for electrical diagramming, which Visio lacks. But ABC FlowCharter can't beat the general-purpose business graphics abilities found in Visio.

Software Publishing Corp.'s Harvard ChartXL fulfills one of the most fervently held wishes of all business charters: It offers guidance for creating whatever kind of chart you need on any given day. Name a chart type and ChartXL handles it. It boasts the broadest choice of chart types we saw, including 2-D, 3-D, bar, pie, bubble, scatter, pyramid, and Gantt. It also offers an incredible amount of control over the most minute details of your charts: You can control and customize every line, legend, color, tick, and label.

ChartXL also includes a healthy dose of statistical analysis tools, such as averages, standard deviations, and variances. The application can even generate attractive graphs from user-defined equations through its powerful Formula Visualizer.

ChartXL gives you lots of guidance too. Its extensive chart gallery includes succinct yet useful descriptions of chart types to help you figure out which one will best illustrate your data. The links to outside spreadsheet applications are strong and intelligent. Once you create the link, ChartXL will update automatically each time you open the chart file.

Though we believe all of these charting tools work best when partnered with a powerful spreadsheet application, one application did impress us with above-average charting tools—for a spreadsheet, that is: Quattro Pro 6.0 for Windows practically pioneered the concept of converting spreadsheets into charts. If you're currently using Quattro Pro, the charting tools in this venerable spreadsheet may satisfy you.



THE REPOSITORY

Any diagram or chart you create will probably end up in some other document, such as a report or a presentation. As a result, you should expect excellent inter-application operability and intelligent tools from your business graphics software, so that a chart or diagram that you place in your presentation doesn't resemble a football player standing on a baseball field.

Whether you're an art-impaired novice, a casual doodler, or an accomplished artisan, you'll want the ease and automation of these tools when your boss tells you to produce a chart of last year's sales backed up by a quality-control flow diagram. Especially when she says to make it *fast*.

Our Contributors: LORI GRUNIN is a frequent contributor to *PC Magazine*. EDWARD MENDELSON and BARRY SIMON are contributing editors of *PC Magazine*. LANCE N. ULANOFF was the senior associate editor in charge of this story, DAN SMITH was the associate project leader, and BEN Z. GOTTESMAN was the technical director.

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Diagramming Tools

By Edward Mendelson

Every new release of diagramming software brings more automation and elegance to the creation of diagrams. Organizational charts, flowcharts, schematics, space-planning charts, and other major diagram types once required painstaking and repetitive manual labor, but today's diagramming software makes these jobs almost effortless. Designed to run under Windows 95, diagramming software is far more flexible, consistent, and powerful than when we last reviewed it, in "Designing Your Thoughts" (December 21, 1993).

Modern diagramming software emerged in Visio's first version, which introduced "smart shapes" with "sticky" con-

nection points that let connecting lines snap into place without manual labor. Smart shapes can now open other pages in the same chart, launch different applications, or display data from spreadsheets and other external files.

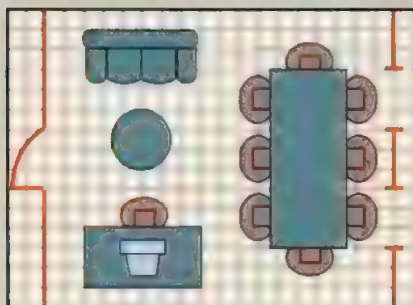
Diagramming programs designed for general business use also now include such features as freehand curves, drawing layers, and preselected color palettes that you could once find only in programs designed for graphic artists. And specialized automation tools that used to appear only in single-purpose programs—those for organizational charts or time lines—have now begun to emerge in all-purpose packages.

For this story, we tested four Windows 95-compatible, general-purpose business diagramming programs: ABC Flow-Charter (now sold as part of the ABC Graphics Suite), ClarisImpact, Drag 'n Draw, and Visio. PC Magazine Labs created and modified a set of standard diagrams to test these packages. We built flow and org charts to test how well each product automates repetitive tasks and handles modifying complex diagrams. We also created floor plans, time lines, word charts, and schematics.

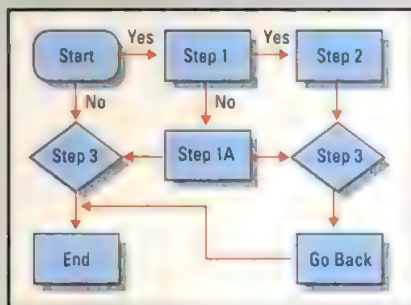
Unlike word processing and spreadsheet software, whose feature sets don't vary much from one major application to another, diagramming programs offer vastly different capabilities. Some packages, such as ABC Graphics Suite, emphasize technical diagrams that create statistical analysis charts directly from spreadsheets. Some give life to business diagrams: ClarisImpact, for instance, automatically creates and updates time line charts when you change the entry in a date or duration field—a feature otherwise found only in project management software. Some packages include 3-D perspective graphics, as Visio does—along with smart support for loosely structured diagrams, such as maps.

While all these packages let you position one set of shapes and lines above or below another set, Visio includes advanced controls over drawing layers that let you decide whether the shapes in one layer connect to the shapes in another. ABC Graphics Suite

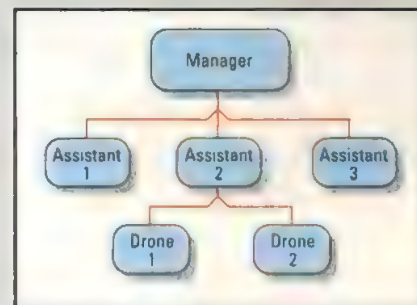
A Visual Glossary: Diagrams for Every Occasion



FLOOR PLANS use symbols for doors, couches, stairs, and other easily recognizable office objects to illustrate the layout of an office, factory, or simple room.



FLOW CHARTS show the process of a project or procedure and how the steps relate to one another. They also illustrate how some decisions process in one direction or the other.



ORGANIZATIONAL CHARTS present the hierarchical structure of individual employees, indicating the branches of authority within a company, establishment, or department.

has connecting lines that sense the position of other lines that cross them, and all of these programs can automatically place connection bumps or small breaks at the crossing points. Visio includes specialized smart shapes for creating pie charts and 3-D graphics. And ClarisImpact uses distinct tools for building org charts, flowcharts, and time lines—all with different automation techniques.

All but one of the four packages act as OLE servers, so you can use a package's own tools to edit a chart in a OLE client presentation package or word processor. The exception, ClarisImpact, tries to make up for its lack of OLE support by including a presentation and word processor module in the same package with the diagramming software.

With the advent of Windows 95 and the Microsoft Office suite's domination of the market, most diagramming packages—with the notable exception of ClarisImpact—now try to look like an Office package as much as possible. Visio, for example, is compatible with Microsoft Office's Binder. ClarisImpact goes its own way, with an idiosyncratic but clear interface that matches its Macintosh version.

Only a year ago, you had to choose between single-purpose diagramming software for depth and general-purpose packages for range. Today, unless you have highly specialized business diagramming needs, you may find everything you need in one or more of the packages reviewed here.

Micrografx Inc.

ABC FlowCharter 6.0

ALL REVIEWS BY EDWARD MENDELSON

ABC FlowCharter 6.0's professional-level, industrial-strength diagramming is only part of the vast riches packed into Micrografx's \$299 ABC Graphics Suite 95. This enormous package ships on three CD-ROMs and also contains Micrografx Designer 6.0 for vector-based illustration and Picture Publisher 6.0 for bitmap editing. All three applications are 32-bit and designed for Windows 95, with a toolbar interface that mimics Microsoft Office. The suite also includes a Windows 95-based clip-art cataloging program, Visual Software's Instant 3D, and two CDs of clip art and fonts.

In addition, the suite comes with a 16-bit version of ABC SnapGraphics 2.0 that you install from a separate folder on the CD-ROM. As the same version of SnapGraphics that shipped with ABC FlowCharter 4.0, it doesn't have the same Windows 95 features found in the rest of the suite. But for beginners who want to create nontechnical diagrams quickly and easily, it does feature an Office-style toolbar and easy-to-use tools. SnapGraphics supports Venn diagrams, targets, pyramids, spoke-and-wheel diagrams, presen-

tation-style checklists, and fill-in forms, as well as standard charts. You won't find any automation, but you do have a wide range of color and shape options.

Less elegant but more powerful than ClarisImpact or Visio, ABC FlowCharter is designed for advanced business and technical diagramming, not for mapping or casual drawing. It handles schematics and network diagrams as well as flowcharts brilliantly, but it won't help you draw a map or floor plan. Its connectors are exceptionally smart: When any two lines cross, the program automatically

creates a crossover "bump" or small break to indicate that the lines do not intersect. This kind of intelligence makes ABC Flow-

Charter the product with the most manageable multipage charts.

SUITABILITY TO TASK		
ABC FlowCharter		
	Power	Ease
Abstract	Excellent	Good
Physical	Good	Good
Integration and customization	Excellent	Good

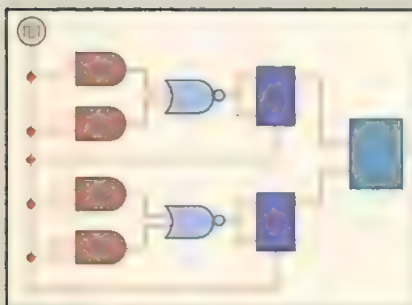
FLOW ABCs

Shape palettes can float outside the main window and can display icons, names, or both. As in Visio, the right-click menu gives you the option to edit a shape and to add or remove anchor points. The drawing window includes rulers and a snap-to-grid that was invisible in the old version but is viewable in the new. Conveniently, you can also select all shapes of a specified type and change their appearance in a single operation.

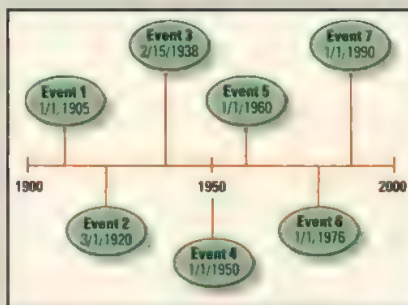
To place a new shape and connect it to another one, you simply click on the new shape from the palette and drag it from the existing shape. When you release the mouse, the shape and the connector both fall into place.

BUILT-IN PROCESS

In earlier versions, ABC DataAnalyzer handled statistical process charts, but an OLE server module, which runs invisibly when you double-click on or create a process chart, now supplies these features. A set of wizards guide you through the creation of Pareto and control charts, scatter diagrams, and other chart types. You can enter data directly into a spreadsheet interface or import it from comma-delimited files, spreadsheets, or text files, and you can display them all in spreadsheet or chart format.



SCHEMATICS are diagrams that use various symbols for wiring, connections, outlets, and even lighting fixtures to illustrate the flow and workings of electrical circuitry.



TIME LINES are used to display the relative position of events chronologically. These events can be broken up into days, weeks, months, decades, or even centuries.

DIAGRAMMING TOOLS

How to Read the Suitability to Task Boxes

All products are rated for both power and ease.

In our **abstract** task, we look at diagrams that map a process, structure, or concept but not necessarily a physical item. In this category, we include two of the most popular types of diagrams, flowcharts and organizational charts. We rate the products based on the wealth of template shapes and their intelligence, as well as controls of layout and appearance.

The **physical** task involves a look at diagrams that represent real-world items. Examples of these include maps, space plans, and network diagrams.

In the **integration and customization** task, we

You can import files from ABC FlowCharter and EasyFlow charts, although, like Visio, ABC also lets you insert OLE objects directly into a chart. Unlike Visio, ABC can't create flow or org charts from imported text files without OLE programming. ABC includes a statistical analysis feature, though, that Visio completely lacks. ABC's 32-bit OLE programming also supports events and triggers, and it lets the creator of a program prevent users from deleting shapes.

One weakness is the scant printed documentation. Though the product has detailed on-line help, you won't find any introductory tutorials. ABC also hides basic procedures—such as automatically linking a new shape to an existing one—deep in the help file.

While you can easily use ABC FlowCharter for quick, casual diagrams, this package really fulfills the demands of large-scale diagramming for government, industry, and research. So if you're more in-

SUITABILITY TO TASK		
Product name		
	Power	Ease
Abstract	Poor	Poor
Physical	Fair	Fair
Integration and customization	Good	Good

examine how well the program and its output work with the user's other applications. This includes OLE compliance and interface consistency with applications such as Microsoft Office. We also look at the ability to create custom shapes, to associate data with shapes, and to write scripts that automate repetitive tasks and interact with other applications.

terested in complex flow and org charts than in the kind of automation wizardry found in Visio, ABC FlowCharter is the product for you.

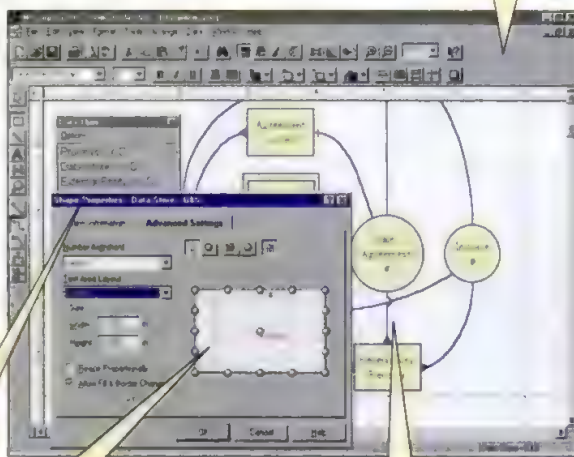
ABC FlowCharter 6.0. Estimated street price: \$299. Requires: 486-based PC or better, 8MB RAM (4MB for SnapGraphics 2.0), 35MB hard disk (10MB for SnapGraphics 2.0), Microsoft Windows 95 or Windows NT 3.51. Micrografx Inc., Richardson, TX; 800-676-3110, 214-234-1769; fax, 214-994-6477; Web, <http://www.micrografx.com>. Circle 455 on reader service card.

There's a Microsoft Office-style toolbar but no compatibility with the Office Binder.

Shape palettes can display names, icons, or both.

You can adjust connecting points and other shape behavior from a pop-up menu.

ABC FlowCharter's connectors optionally display bumps or breaks when they cross.



Claris Corp.

ClarisImpact 2.0

ClarisImpact 2.0, originally a Macintosh program, reigns as the most visually sophisticated diagramming software available for Windows. This \$99 package from Claris Corp.—whose interface resembles its Mac counterpart—is the only one in this evaluation that provides preset harmonious color schemes and typographic styles for various moods and purposes.

Claris has created a product that uses innovative, effort-saving techniques for building and modifying org charts, time lines, and flowcharts. And like a spreadsheet the product can create a variety of diagrams from numerical data. ClarisImpact is a creative and enjoyable diagramming package, but if you want schematics and other technical diagrams, floor plans, or maps, look elsewhere.

ClarisImpact does diagramming best. It also includes good-looking—though not especially powerful—table, presentation, drawing, word processing, and outline modules (all with the same file format and interface), but they won't take the place of standalone packages. The presentation module offers little more than a set of predefined styles, and the word processor and outliner really suit beginners best.

NOT LIKE THE REST

Unlike other diagramming packages in this evaluation, ClarisImpact doesn't have a single palette-and-page model for building all diagram types. Even so, you can use the supplied clip-art and line tools to construct virtually any kind of diagram. ClarisImpact's strong set of highly specialized tools for building org charts, flowcharts, and time lines shines.

Each type of diagram in ClarisImpact uses a separate toolkit. When you build a flowchart, for example, the shape palette displays a set of tools that add shapes to the chart. You select a shape in the diagram, go to the palette to click on a additional shape, and then click a button to place the selected shape—sideways, or above or below the shape from the palette. And you can even build a whole diagram without dragging a single shape onto the page. If you prefer to work on the page, a set of

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tools connected to the currently selected shape simplifies the job.

Org charts tools are even more ingenious. When you select a position (or job description) from the chart, handles appear that let you add a manager, coworker, subordinate, or assistant with a single click. Each position automatically obtains the color, outline, shadow, and text style assigned to its level in an easily customizable palette. You can collapse any branch in ClarisImpact (a icon symbolizes the place of collapse), and in case you want to make adjustments to the chart, you have many Clean Up options. And ClarisImpact handily makes a new chart fill a single page, grow automatically to spread over multiple pages, and then occupy only a single page again if you resize it at print time.

ClarisImpact also creates org charts by importing comma-delimited text files, and it can convert an org chart into text-only outline format and back into a chart. When you convert from chart to outline, you lose the formatting, but you can reapply the original stylesheet when you return to chart format.

TIMELINESS

ClarisImpact's time lines use the same type of automation found in standalone project management packages. You enter a task's starting time and duration (or completion date) and the program automatically draws the graphic time line. You won't find this feature in any other all-purpose diagramming software reviewed here.

With just a few mouse clicks, you can build calendars. And all supported diagram types can appear on a single page. But you can't create sticky connectors between shapes in two separate flowcharts (or between a flowchart and a position in an org chart), because each diagram occupies a separate layer on the page. You can display or hide page borders, and a zoom command lets you view a dozen or more pages at once, depending on your screen size.

ClarisImpact is a 32-bit, Windows 95-compatible app that also runs on Windows NT and ships with the Win32s files you'll need to run it under Windows 3.1. But you won't find the Windows 95 tooltips or features such as full support of long filenames, right-click pop-up menus, or OLE. Yet its excellent manual, unique automated tools, and nice range of functions make it a pleasure to use.

ClarisImpact 2.0. Estimated street price: \$99. Requires: 386-based PC or better, 4MB RAM, 10MB hard disk (Microsoft Windows 3.1); 386-based PC or better, 8MB RAM, 10MB hard disk (Windows 95). Claris Corp., Santa Clara, CA; 800-544-8554, 408-727-8227; Web, <http://www.claris.com>. *Circle 456 on reader service card.*

SUITABILITY TO TASK		
ClarisImpact		
	Power	Ease
Abstract	Excellent	Excellent
Physical	Fair	Good
Integration and customization	Fair	Good

mand lets you view a dozen or more pages at once, depending on your screen size.

ClarisImpact is a 32-bit, Windows 95-compatible app

DeltaPoint Inc.

Drag 'n Draw 1.1

DeltaPoint's \$149 Drag 'n Draw 1.1 offers simple and intuitive functionality in a wide range of diagram types. With its highly customizable interface and detailed, hand-holding help, this small-scale package has enough built-in templates and shapes to serve users who have basic and undemanding graphics needs.

Drag 'n Draw lacks the automated, high-precision features of more ambitious packages. And it is a *drag* to draw complex org charts and other elaborate diagrams:

*For simple
diagramming in a
compact application,
you won't find anything
less complex to use than
Drag 'n Draw 1.1.*

Instead of using automated shortcuts, you have to draw each element and connection by hand. But for simple diagramming in a compact application, you won't find anything less complex to use. It's also worth noting that Drag 'n Draw will recognize which operating system you're running and will install either its Windows 3.1 version or the native Windows 95 one.

With its basic drawing tools and 75 symbol palettes, Drag 'n Draw lets you create charts from scratch. But you'll probably start with one of its 16 diagram templates of sample charts, which include detailed hint screens that pop up to tell you what to do next, and which can be turned off if they become intrusive. You can also change the text in the samples, add elements by copying or dragging, and remove the elements you don't need. The product also includes 16 page border templates that you can use to create menus, certificates, and similar designs.

Drag 'n Draw's screen consists of an editing window with rulers, an editing and text-formatting toolbar, and a second toolbar with three basic line styles and 24

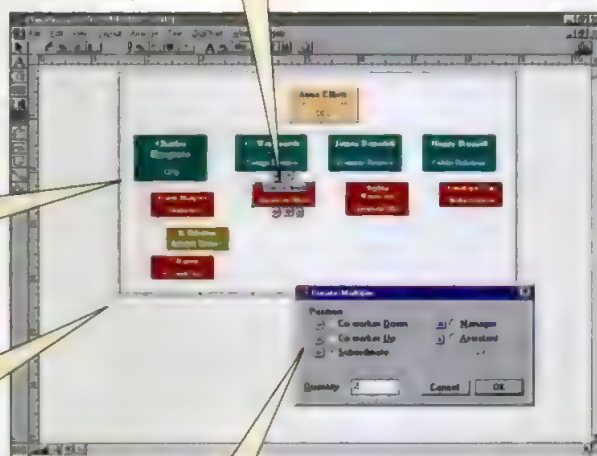
Tools on selected shapes let you add positions or hide subordinates.

Preset color selections apply harmonious colors to each chart element.

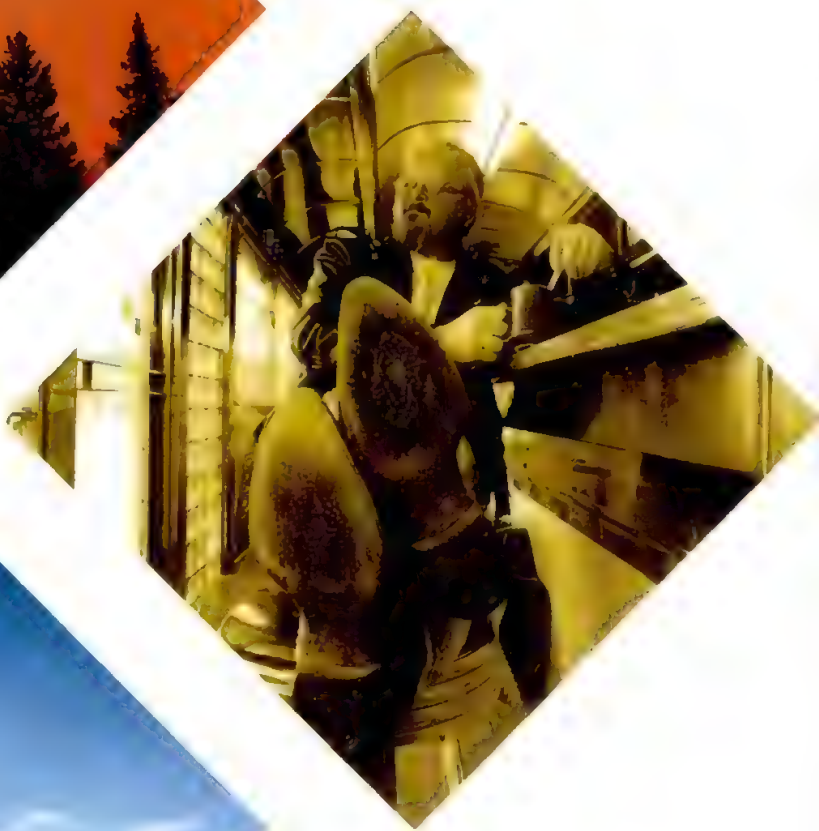
Each ClarisImpact diagram is contained within a nonprinting frame.

Nonstandard icons, such as these for zooming in and out, can make learning difficult.

You can add multiple positions in a single operation from a dialog box.



Gateway 2000



Portable PCs



Aurora borealis. The perfect excuse to get away.

Made sure the battery on my Gateway Solo™ S5-120XL multimedia

notebook was charged, fueled up the truck and headed north. Second quarter projections could wait.

I watched Mother Nature's display dance across the northern sky. And life just seemed to make sense. Looking at my Gateway

Solo S5-120XL multimedia notebook I thought, this machine also makes perfect sense. Think of it. A powerful 120MHz Intel® Pentium® processor, active matrix SVGA color display, 40MB RAM, whopping 1.2GB hard drive, and CD-ROM drive. All the power of a high-end multimedia desktop in a portable package. Who needs more?

A German opera filled the night.

I was deep in thought. Thanks to the swappable CD-ROM drive and integrated speakers, features found on all models of the Gateway Solo multimedia notebook line, my favorite German opera filled the night.

Suddenly I heard hoofbeats.



GATEWAY2000
S O L O

Turning I found myself face to chest with a large white horse.

"Hello madam," said the uniformed man atop the horse.



"Is that a Gateway 2000 portable?

What a coincidence, I have one too!"

Desktop power that fits on a horse.

He reached into his pack and pulled out a Gateway Solo S5-75XL notebook. "My S5-75XL is loaded with a 75MHz Pentium processor, 8MB RAM, and 540MB hard drive. With the 16-bit

sound, stereo

speakers and a

CD-ROM

drive, I can use multi-

media applications anywhere.

Even in the boondocks. And

the active matrix color display provides a great view."

This value-packed system is ideal for the professional person on the go such as myself. And the best part, it fits on a horse," he said with a smile. "Gateway 2000® is the place to go for great values on portable PCs. And while you can compute anywhere, I must ask



EZ Pad™ pointing device for easy cursor navigation.

you to cease and desist." I gave him a

questioning look. He continued, "It's

mating season for many of our furry friends

and we wouldn't want the glow from your

**More cc
more**

active matrix color display ruining their plans. Thank you madam and enjoy your evening." And with a tip of his hat, off he rode.

My commune with nature over, I found an offbeat diner and stopped in for some food. I felt someone watching me. As I scanned the room, our eyes met.

He was sitting at the counter,

a Gateway Liberty™ small

notebook in front of

him. He looked

vaguely familiar. I

pointed to my portable

and mouthed, "Gateway 2000." He smiled and gave me a



computing,
places.

thumbs
up. "My
Gateway

Liberty small
notebook is way

cool," he said, pulling up a chair. "Powerful
and light-weight, man. It's just what I need.
I'm a poet now. But I used to have a band."



Gateway Solo notebooks
are optimized for Microsoft®
Windows® 95.

A band!

Memories of him in a
silver jumpsuit and
platform shoes came
flooding back! He'd
been plastered all over



**I'm telling you,
Gateway is just great!**



Models from the Gateway Solo
multimedia line have a
modular CD-ROM drive.

my bedroom walls for years.

"I'm telling you, Gateway

2000 really takes care of their

customers. I can get

telephone

technical support anytime. And

Gateway's values are just out of this

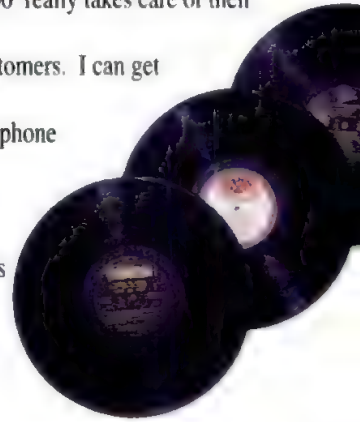
world. Hey, you wanna come over

to my place and listen to some

vinyl?" I had a feeling my adventures were just

beginning.

For more computing, more places —
call Gateway 2000 today.



GATEWAY2000
You've got a friend in the business

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SS-75XL

- 10.2" VGA Color Display
- 75MHz Intel® Pentium® Processor
- 8MB RAM (expandable to 40MB)
- 256K L2 Pipelined Burst Cache
- 540MB Hard Drive
- Modular 2X CD-ROM Drive
- 3.5" Modular Floppy Drive
- Integrated 16-Bit Sound with Stereo Speakers
- 1MB Video RAM
- Lithium Ion Battery & AC Pack
- EZ Pad™ Pointing Device
- 86-Key MS Windows 95 Keyboard
- Parallel, Serial, Infrared, VGA & PS/2® Ports
- Built-In Mic, Headphone and Line-In Jacks and External Volume Control Dial
- 11.8" x 8.8" x 2.0"
- Microsoft® Windows® 95**
- MS Works 95
- Carrying Case

\$3299

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- 10.2" VGA Color Display
- 90MHz Intel Pentium Processor
- 8MB RAM (expandable to 40MB)
- 256K L2 Pipelined Burst Cache
- 540MB Hard Drive
- Modular 2X CD-ROM Drive
- 3.5" Modular Floppy Drive
- Integrated 16-Bit Sound with Stereo Speakers
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- Built-In Mic, Headphone and Line-In Jacks and External Volume Control Dial
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- 16MB RAM (expandable to 40MB)
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- 1.2GB Hard Drive
- Modular 2X CD-ROM Drive
- 3.5" Modular Floppy Drive
- Integrated 16-Bit Sound with Stereo Speakers
- 1MB Video RAM
- Lithium Ion Battery & AC Pack
- EZ Pad Pointing Device
- 86-Key MS Windows 95 Keyboard
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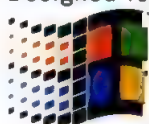
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basic shapes that you can drag into the editing window. After you use a line or shape tool, the mouse pointer reverts to a selection tool. Fortunately, you can hold down the Shift key when clicking on a line or shape tool to force it to remain active. In addition to the basic shapes on the toolbar, the screen can simultaneously display up to four symbol palettes.

These palettes contain about 1,500 shapes for use in electrical schematics, flowcharts, floor plans, network diagrams, maps, and other business graphics. These moderately intelligent shapes let you attach lines to anchor points when the end of a line approaches a shape. But this feature doesn't always work the way you expect: With the snap-to-grid option turned on,

sometimes a line won't link with a shape until you nudge the shape with an arrow key. And when you try to draw a line between two almost adjacent points using the stepped-line tool, the program sometimes

SUITABILITY TO TASK

Drag 'n Draw

	Power	Ease
Abstract	Fair	Fair
Physical	Poor	Fair
Integration and customization	Fair	Fair

inserts a long stepped line that makes this procedure more complex.

Unless you choose to constrain them, shapes automatically expand when you fill them with text. A menu option lets you select two or more shapes and make them all

the same size as the last one selected. But if you resize, shapes don't align and connecting vertical lines slant—so you have to nudge some boxes into position, reselect multiple boxes, and choose another menu option to align them. All these adjustments require trips to the menus; neither the toolbars nor the icons accomplish these tasks.

CUSTOMIZE CREATION

A well-designed style feature in Drag 'n Draw lets you create custom settings for the colors, borders, and shadows of text and boxes and apply all these styles to any chart or shape. You can load a default set of shape and text styles only if you save a template and then find the unintuitive option that loads that

Corel Flows In with the Rest

CorelFlow 3.0 shipped too late for us to review it, but PC Labs examined a prerelease version of Corel Corp.'s \$199 diagramming package. We were impressed by its range, depth, automation, and integration. Version 2.0 was still available from Corel (800-772-6735, 613-728-8200) at press time, but because the third release will be on the streets by the time you read this, we chose not to review Version 2.0.

The Windows 95-only Version 3.0 implements virtually all the most effective features of other diagramming packages and adds many unique features. Smart connectors not only support intersection bumps and stay out of the way of drawing objects, but they can include arrows at every node, and a set of footprints can replace these smart connectors. You can add almost anything to a shape palette or diagram, including objects from the Windows desktop such as Internet addresses.

Microsoft Office compatibility features include support for the Office Binder, and CorelFlow even offers many features found in CorelDraw 6, including advanced text formatting, automatic abbreviation expansion, smart quotation

marks, customizable fills, and other drawing tools.

FLOW SMARTS

CorelFlow's highly intelligent wizards build org charts, flowcharts, time lines, and calendars either directly from your keyboard input or from text files on-disk. Unlike the wizards in rival products, Corel debugs your input for consistency, and in an org chart, it will tell you exactly what position doesn't report to anyone. Unlike ABC Flow-Charter, Visio, and some modules of ClarisImpact, however, CorelFlow isn't designed as a graphics front end

for data that you can display and modify in spreadsheet format.

Well-designed convenience features include undo functions (99 levels), a "rubber stamp" feature that inserts a shape when you click the mouse (and which you don't have to drag from a template), and a feature that automatically connects all shapes in a chart by the order that you inserted them. Corel hasn't built in many keyboard shortcuts, but you can assign all actions to keys or toolbars. You may find it hard to get used to the connector tool which requires you to double-click when you finish drawing a line; if you only single-click, you'll continue drawing the same line when you move the mouse.

CorelFlow includes the CorelScript Editor macro recorder and programming language, also found in CorelDraw.

CorelFlow comes with 6,400 symbols in 205 libraries that support virtually every type of diagram from space planning to schematics. If you need close links between external data and your diagrams, you'll probably want to look elsewhere. But for most standard business diagramming tasks, CorelFlow looks like a strong contender.—Edward Mendelson



CorelFlow lets you replace ordinary graphic lines with footprints or other patterns. Multiple palettes can be displayed at one time and rolled up to save screen space.

template for each new drawing.

The right-click pop-up menu gives you the option to modify any diagram shape. You can also adjust connection points, expansion and contraction behavior, and text location for palette shapes, all from a simple menu. To add new shapes to the program's built-in supply, you can import Windows metafiles from the Clipboard, or draw a shape in the editing screen and copy it to the Clip-

Drag 'n Draw's highly detailed help explains the program's response to any action.

board. Drag 'n Draw's manual doesn't tell you, though, that if you draw a shape with the line tool, you have to group the line segments before the program recognizes the shape.

Drag 'n Draw provides hundreds of shapes for dozens of diagram types, and it gets less complex jobs done quickly. Although DeltaPoint deliberately aimed to design a simple and easy Drag 'n Draw, you may actually find one of the larger and more automated packages simpler and easier to use than the repetitive manual operations required by Drag 'n Draw. **Drag 'n Draw 1.1.** List price: \$149. Requires: 386-based PC or better, 4MB RAM, 2MB hard disk (Microsoft Windows 3.1); 486-based PC or better, 8MB RAM, 2MB hard disk (Windows 95). DeltaPoint Inc., Monterey, CA; 800-446-6955, 408-648-4000; fax, 408-648-4020; Web, <http://www.deltapoint.com>. Circle 458 on reader service card.

Visio Corp.

Visio 4.0



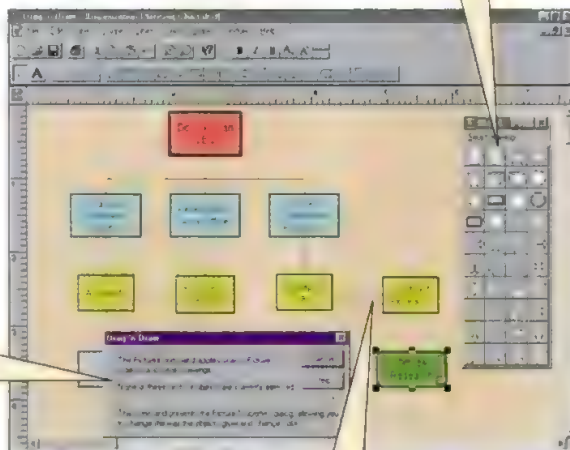
The Windows 95-compatible Visio 4.0, \$249 from Visio Corp., not only retains the astonishing range, convenience, and automation features of earlier versions, but the application now includes new wizards for effortless chart construction, improved drawing tools, three-dimensional perspective, and support for the Microsoft Office Binder.

16- and 32-bit versions in the same box.

THE VISIO THING

Visio comes with a dazzling variety of diagram types and shapes, and the product packs its menus with a toolkit of commands for aligning, annotating, formatting, selecting shapes or lines, importing and exporting data, and creating and modifying shapes.

The shape palette displays icons or their associated names but not both.

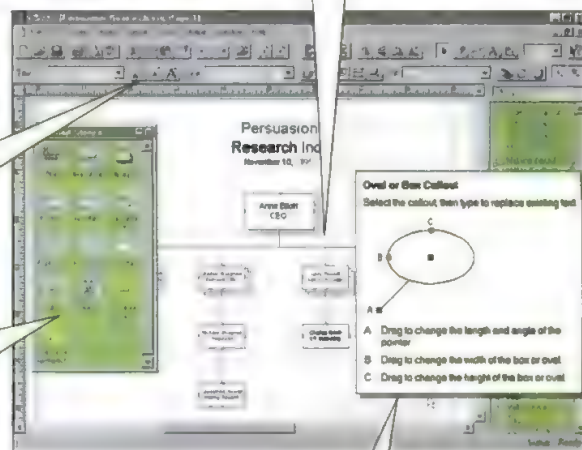


A symbol in a shape, such as this plus sign, can indicate a link to another chart.

Visio tries to do everything imaginable in a diagramming package. And although in some specific areas it can't match the depth of ABC FlowCharter's statistical diagrams or ClarisImpact's automated time lines, Visio's overall breadth remains unequaled. Users who need direct import/export of AutoCAD files and a more technically oriented set of shape templates and add-ons should consider Visio Technical, the \$399 superset product. Both Visio and Visio Technical come with

Well-stocked toolbars give access to all major formatting and display features.

Shape palettes can float and display icons, names, or both.



Connection points remain faintly visible on nonselected shapes.

Visio's detailed pop-up help boxes tell how to manipulate each shape.

Other menu options include a spreadsheet-style interface that numerically—instead of graphically—defines shapes and sliders that let you adjust the stickiness of connections. Some shapes display the kind of intelligence you'd expect from high-priced graphics packages: You can stretch shapes intelligently to create bar charts so that each bar is a stylized arm and hand. The hand on each bar remains the same size while the arm differs in length, and the shapes in 3-D perspective charts automatically adjust their orientation when you move the vanishing point. You can even place multiple vanishing points on a diagram and attach each shape to a different point.

Visio lets you create diagrams either manually—dragging shapes and connecting lines from a palette—or by the automated method—importing a data file that automatically converts into org or flowcharts and time lines. Visio, though, doesn't support statistical analysis charts out of the box; if you want to create them, you'll need to use the package's OLE programming language. As you create certain charts by hand, the smart anchor points make connections neatly when a

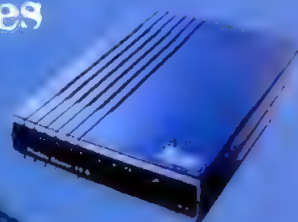
line comes close to a shape. If you move a shape, Visio cleverly moves its connecting lines from one anchor point to another.

Visio doesn't provide a bird's-eye view, so you may be confused by the

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SUMMARY OF FEATURES

Diagramming Software

■ YES ■ NO

Products listed in alphabetical order

ABC Flow-
Chart 6.0

ClearImpact 2.0

Drag 'n Draw 1.1

PC MAGAZINE
EDITOR'S CHOICE

Visio 4.0

General Features

Price	\$299 (street)	\$99 (street)	\$149 (list)	\$249 (list)
Minimum memory required	8MB	4MB	4MB	8MB
Minimum disk space required	35MB	10MB	2MB	6MB
File sharing	■	■	■	■
Variable zoom	■	■	■	■
OLE 2.0 client/server	■ ■	■ ■	■ ■	■ ■

Chart Characteristics

Predefined diagram types	32	32	30	29
Predefined shapes	2,000	2,000	1,500	1,000
User can draw shapes	■	■	■	■
User can create master shapes	■	■	■	■
User can create new stencil files	■	■	■	■
User can add colors to shapes	■	■	■	■

Text Characteristics

User can add text to shapes	■	■	■	■
User can size, move, and rotate text	■	■	■	■

Page Layout

User can assign background and foreground pages	■	■	■	■
User can create page templates	■	■	■	■
User can edit backgrounds	■	■	■ (color only)	■
User can set page-display options	■	■	■	■
User can work in layers	■	■	■	■

Databases Characteristics

User can link data to graphics elements	■	■	■	■
Maximum number of fields	Unlimited	Unlimited	N/A	64K
Maximum characters per field	255	255	N/A	64K
User can add notes to a field	■	■	N/A	■
User can suppress printing of a field	■	■	N/A	■

File Formats (Import/Export)

.BMP	■ ■	■ ■	■ ■	■ ■
.PCX	■ ■	■ ■	■ ■	■ ■
.TIFF	■ ■	■ ■	■ ■	■ ■
.WMF	■ ■	■ ■	■ ■	■ ■

Printing Options

Automatically fit to page	■	■	■	■
Set margins	■	■	■	■
Tile across pages	■	■	■	■

Documentation and Support

Technical-support hours (eastern time)	9:00-7:00 M-F	9:00-9:00 M-Th; 9:00-5:00 F	10:00-8:00 M-F	9:00-8:00 M-F
Tutorial	■	■	■	■

N/A—Not applicable. The product does not have this feature.

original page's sudden disappearance from the screen and the lack of on-screen indication that the page still exists—or even that the diagram now consists of multiple pages. And if you want to see more than one page at a time, you have to open a separate window for each.

To build a diagram automatically, simply run one of the supplied wizards: They

build diagrams from spreadsheet or text files, and although you have to figure out the finer details of building an import file, the basic principles are clear.

SUITABILITY TO TASK

Visio

	Power	Ease
Abstract	Excellent	Good
Physical	Excellent	Good
Integration and customization	Excellent	Excellent

pop-up menus. The toolbars provide a wealth of functions, including a multilevel undo icon, a pencil tool that converts into

an effective free form drawing pen, and intuitively designed devices for rotating or cropping shapes. The smart connector tool brings together the shape that you drag into a diagram and the last shape you selected.

The drawing window has rulers and an optional grid. Pop-up menus can include

*No matter what
your diagramming
needs are, fully
developed Visio gets the
job done beautifully
and efficiently.*

user-specified actions, and you can assign shapes to layers, as in an office layout diagram that has separate layers for wiring, furniture, and equipment. You can also snap shapes from one layer to another, make layers invisible, or lock layers.

Shape palettes can float outside the program window and show shapes by name, icons, or both, and you can display as many palettes as you need. Right-click menus let you drill down to dialogs that modify the characteristics of individual shapes, and Visio's drawing tools can easily import any image and place connection points where you want them. The responsive and precise free-form tool uses the B-spline technology normally found in high-end drawing apps.

Fully developed, Visio has no serious problems in performance and stability. The automated wizards, written in Visual Basic and C++, are inevitably slower than the rest of the program, but no matter what your diagramming needs are, Visio still gets the job done beautifully and efficiently.

Visio 4.0. List price: \$249. Requires: 386-based PC or better, 4MB RAM, 8MB hard disk, Microsoft Windows 3.1 (16-bit); 386-based PC or better, 8MB RAM, 8MB hard disk, Windows 95 or Windows NT 3.51 (32-bit). Visio Corp., Seattle, WA; 800-446-3335, 206-521-4500; fax, 206-521-4501; Web, <http://www.visio.com>. Circle 465 on reader service card.

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Charting Software

By Lori Grunin

When you need to analyze or present data, nothing helps you expose patterns more quickly than a chart. The more complex your data, the more complex the chart, and only sophisticated software can make each chart comprehensible.

In some ways, charting software has met this challenge over the past few years. The best products now provide guidance, telling you what chart types to use and walking you through the process of mapping data to chart elements. When you need to change chart types or revise the data in a chart, these products properly pick up the new formatting and perform with a minimum of fuss. They also provide tools for fitting

curves to your data and other methods of visually refining the chart so that you can more easily spot the underlying trends and patterns. And because style sometimes ranks as high as substance, they give you a wealth of ways to dress up your charts, from graphics annotations to gradient fills to custom data markers. Finally, they can act as OLE container and server, and they can export to a variety of graphics file formats, so you can effortlessly transform graphs into reports and presentations.

WHO'S HERE

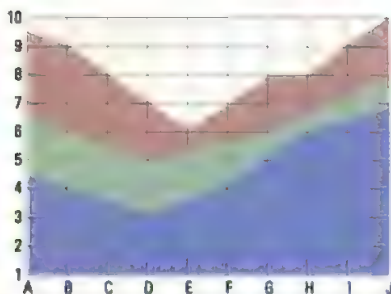
Product requirements for this roundup included integral charting capabilities and

support for a core set of chart types. (We excluded presentation software, which we'll be covering in an upcoming issue.) We ended up with six products, three spreadsheet packages and three dedicated charting packages: DeltaPoint's Delta-Graph Pro, Lotus 1-2-3 Release 5 for Windows 3.1, Microsoft Excel for Windows 95, Novell's Quattro Pro for Windows, Software Publishing Corp.'s Harvard ChartXL, and Visual Numerics' Stanford Graphics. While all of these products run on Windows 3.x, ChartXL comes in dual Windows 95 and Windows 3.x versions, Excel works with Windows 95 and Windows NT, and Stanford Graphics' recompile (3.0c) now runs on Windows 95 and Windows NT.

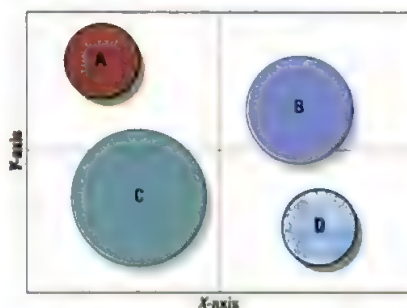
We evaluated these products for their data-handling, charting, formatting, and integration capabilities on a Gateway 2000 4DX2-66V with 28MB RAM and an ATI Graphics Pro Turbo card. To test the data-handling skills, we imported and linked data in several formats and examined how easily we could manipulate it and how well the product dealt with missing values. We then generated a variety of business and statistical charts, which we reconfigured and reformatted. Finally, we exported the charts to supported file formats, printed various charts on both an NEC Silent-Writer 95f and an Epson Stylus Color, and embedded them into Microsoft Word for Windows 95 as OLE objects.

One clear conclusion emerged: Spreadsheet and charting applications re-

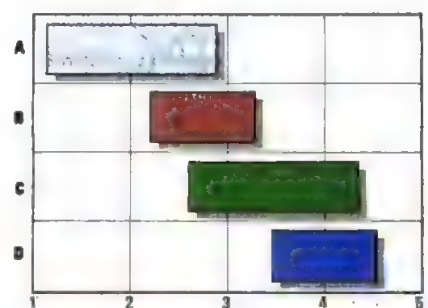
A Visual Glossary: Charts for Every Occasion



AREA CHARTS can show how trends track over a continuous period of time, measured in hours, days, weeks, or even years. They demonstrate how each item, or each trend, contributes to the sum of all items.



BUBBLE CHARTS are designed for comparative positioning. They display two independent variables for each item through horizontal and vertical positioning on solid circles.



GANTT CHARTS are ideal for project management, showing the start and stop times of a project's specific tasks. In more complex Gantt charts, dependencies can be created between the bars.

main codependent rather than competitive. Though spreadsheet packages offer strong data handling, their charting skills lag behind. In general, they supply only a few basic chart types.

Though charting packages bring a wealth of chart types and visual data analysis tools to the table, only a spreadsheet can manipulate any kind of data. For instance, none of the charting products let you search and replace in the data sheet, which makes it difficult to find missing data. And none handle time series data quite as ably as the spreadsheets do. For more advanced data handling combined with comprehensive charting capabilities, you need to look at more technical, vertical packages or statistics programs. (See the sidebar "Getting Technical: Scientific Graphing Programs").

Charting is hardly a new product category, though traditionally the analysis of data and its presentation have forged an uneasy alliance. But today's tools make it easier than ever to put the two together.

DeltaPoint Inc.

DeltaGraph Pro 3.5

ALL REVIEWS BY LORI GRUNIN

As a charting complement to a spreadsheet package, DeltaGraph Pro 3.5, \$195 from DeltaPoint, has a lot to recommend—but not when compared with Harvard ChartXL or Stanford Graphics as a standalone charting package. At its best,

DeltaGraph offers a relatively broad selection of chart types and excellent formatting skills. At its worst, however, the product delivers instability and the frustrations of a Mac-centric interface. DeltaGraph runs on Windows 3.1 (with

Win32s) and Windows 95.

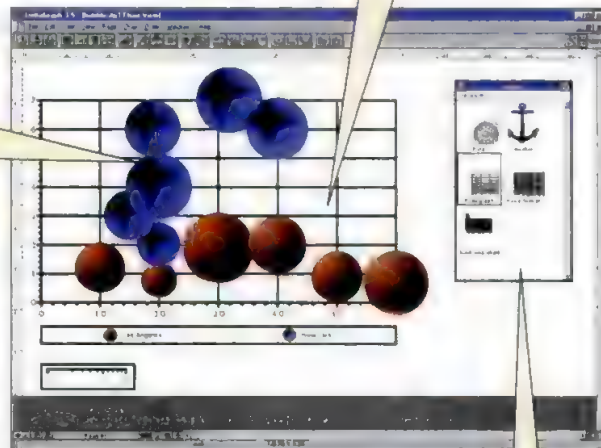
You create charts the same way as in a spreadsheet's charter: You select your data and pick a chart type from the Chart Gallery (with optional suggestions from the Quattro Pro-like Chart Advisor). One of the program's best tools is its Library, a floating palette that contains any custom charts or graphics you've dragged or pasted into it. To create a custom chart, you just drag the thumbnail from the Library onto your chart page and then select the data.

DO IT OUR WAY

As with Harvard ChartXL and Stanford Graphics, you may also choose to create plots from sample data. In DeltaGraph's case, though, you'll need to do so to figure out how your data will look for a given chart type. Unlike the rest of the products

DeltaGraph Pro offers a broad number of chart types, though not as comprehensive a set as Harvard ChartXL or Stanford Graphics.

DeltaGraph Pro's fill flexibility surprised us: Options include several exotic gradient fills and pictographs.

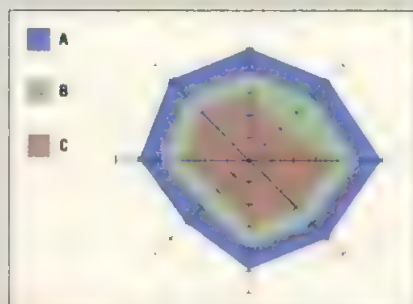


With DeltaGraph Pro's Library, all you have to do to create a custom chart is drag a saved chart model onto the page and select the relevant data.

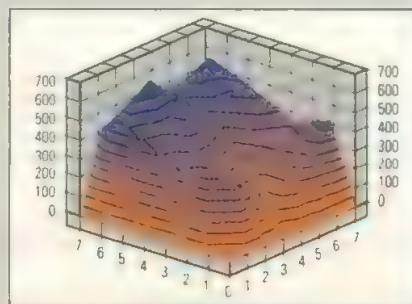
in this story, DeltaGraph doesn't let you map ranges to chart elements. It expects labels in the first row and column of the data sheet and data in the others, but in rigidly defined locations (though you can chart only a subset of the data in the sheet).

Then you'll want to massage your data in your spreadsheet package, because of all the products reviewed here, DeltaGraph handles data the worst. When the product didn't understand our serial date/time data, we had to format it as standard date/time and paste it in from Excel. We had to type NA's in all our empty cells because DeltaGraph doesn't support copying from one cell and pasting into multiple cells. The data sheet doesn't support many typical keyboard shortcuts—such as PgDn to scroll through the data or Shift-Arrow to select multiple contiguous cells. When we specified that our series resided in rows rather than in columns, DeltaGraph consistently crashed our system at plot time.

Once you've created your chart, though, the going gets easier. DeltaGraph's Revise Data command jumps you into the data sheet to select a new subset and new axis labels. You can also format your charts rather easily. Drilling down through a chart to select a given object works very smooth-



SPIDER CHARTS present a number of separate values in related groups that help identify strengths and weaknesses. Here, the outer circular grid does not appear, giving the chart an "open experience."



SURFACE CHARTS show a matrix of x-, y-, and z-values on a 3-D grid that resembles a fishnet. The data has x-values in the first column, y-values across the row, and z-values in the matrix.

CHARTING TOOLS

How to Read the Suitability to Task Boxes

All products are rated for both power and ease.

In our **business charting** task, we look for a complete set of core business graph types. Products that also include more esoteric types, such as linked pies and doughnuts, rate more highly.

The **technical charting** task involves examining the breadth of technical chart types, including scatter and plot. Support for additional chart types enhances the product's score. For this and the previous task, tools that assist the user in selecting and creating the right chart figure into the *ease* rating.

Presentation and integration ratings reflect the

ly, and DeltaGraph lets you preview most operations. Though it lacks some formatting capabilities, the program usually makes up for them in other ways. For instance, you can't stagger labels, but you can rotate them to any angle. And DeltaGraph's palette handling is more intelligent than ChartXL's and Stanford Graphics', and it offers a broader selection of fill types. When creating pictographs, DeltaGraph is the only product that gives you full control over the tiling and placement characteristics of the fill graphic, a necessity for visual accuracy. It also lets you specify absolute lengths for the axes, which means you can specify the correct aspect ratio for charts.

AT THE DELTA

DeltaGraph also includes some very powerful data analysis tools. For instance, we really liked the way it handles curve fitting: All the types it supports—including n -degree, polynomial, and user-defined—appear in a single dialog screen. It generated our eighth-order polynomial relatively quickly, and DeltaGraph's overall performance was the zippiest of the bunch when working with our 3,000-point time series chart. As you select the different types, you see the equation and its correlation coeffi-

SUITABILITY TO TASK		
Product name		
	Power	Ease
Business charting	Poor	Poor
Technical charting	Fair	Fair
Presentation and integration	Good	Good
Visual data analysis	Excellent	Excellent

usefulness of tools (including color schemes and gradient tools) that let users format, print, and export charts, as well as tools for OLE linking.

In our **visual data analysis** task, we examine tools that allow users to identify specific data points in charts and visually extrapolate further analysis.

cient(s). This gives you a very easy (although not very scientific) way to find a good fit.

Like Stanford Graphics, this program offers some presentation features; but unlike Stanford Graphics', they don't clutter up the charting process. The way you navigate the program resembles ChartXL's intelligent method, but DeltaGraph also supports creating files with multiple charts.

SUITABILITY TO TASK		
DeltaGraph Pro		
	Power	Ease
Business charting	Good	Good
Technical charting	Good	Good
Presentation and integration	Good	Good
Visual data analysis	Good	Good

ments outside the page boundaries. And the program can't act as an OLE server; it even pastes charts as pictures within itself. We found both print quality and file export acceptable.

If you work heavily with time series data or perform forecasting, or if you need a program with flexible data handling, then DeltaGraph Pro won't do the trick at all. For most other purposes, it will do a workmanlike job.

DeltaGraph Pro 3.5. List price: \$195. Requires: 386-based PC or better, 8MB RAM, 7MB hard disk, Microsoft Windows 3.1, DOS 4.01 or later. DeltaPoint Inc., Monterey, CA; 800-446-6955, 408-648-4000; fax, 408-648-4020; Web, <http://www.deltapoint.com>. Circle 457 on reader service card.

Software Publishing Corp.

Harvard ChartXL 2.0



Rising above the rest of the crowd, Software Publishing Corp.'s \$149 Harvard ChartXL 2.0 impressed us with its charting breadth and depth, and its well-designed user interface.

With the same charting engine as Stanford Graphics, ChartXL's more polished design and expanded set of business charting and analysis tools make it easier to use and more applicable for mainstream users. A Windows 95 package, ChartXL also runs under Windows 3.1 and Windows NT.

As with Stanford Graphics, you can associate ranges of data to graph elements with the Range Highlighter. The program lets you create named ranges to update charts with different data subsets more easily. Unlike DeltaGraph Pro, in which you must type in the full range name to make this association, Stanford Graphics allows you to pick named ranges from a list.

You choose your chart type from either an abbreviated list or an expanded Gallery, which provides both thumbnails and brief, user-editable descriptions of the different chart types. ChartXL offers the broadest choice of business chart types, including pyramid and Gantt, as well as a selection of statistical and technical charts that matches Stanford Graphics' and DeltaGraph Pro's selections. You can also save customized charts as Gallery graphs, and they appear as Style Templates. You can access these templates from ChartXL's Auto Format menu selection.

FORMATTING AT HARVARD

Like Stanford Graphics, ChartXL provides excellent formatting controls, accessible via the same right-mouse menus and, with only some minor differences, the same dialog boxes. When we created our time series chart, we found the program's option that displayed first and last labels very useful (a feature found in Stanford Graphics as well). We slanted the labels to fit in as many as possible, though you can also stagger and wrap them if you prefer. And ChartXL provides a good selection of fill types, including gradients, patterns, and pictures.



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TILT/ROTATION CONTROL	YES	YES	YES	NO	YES	YES
PINCUSHION CONTROL	YES	YES	YES	YES	YES	YES
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COLOR TEMPERATURE CONTROL	YES	YES	NO	YES	YES	YES
BNC-5 CONNECTORS	YES	YES	YES	YES	YES	YES
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You'll also find it a snap to format lines, fonts, and any other attribute you can think of, including user-definable number formats (a feature that Delta-Graph Pro lacks). We were able to offset the axis by simply dragging it to the desired location and manually defining axis lengths in order to preserve the chart's aspect ratio.

STAT SMARTS

The program provides many but not all of the same analysis tools found in Stanford Graphics: For example, ChartXL lacks some of Stanford Graphics' more exotic curve-fit types—such as fast Fourier transform—and it offers fewer options for the ones it does share. It does let you insert curves to move data of various statistics—including averages, standard deviations, and variances.

ChartXL also includes the Data Cursor, which reports the x-, y-, and z-values of a selected data-point location in the cell as well as in the spreadsheet. And if you drag the point, the program will update the value in the sheet—but only in 2-D graphs. We wish that Software Publishing Corp. would extend the capabilities of this ChartXL feature to include 3-D graphs. But as with Stanford Graphics, we appre-

ciated ChartXL's Formula Visualizer, which generates graphs and data from user-defined equations.

ON THE AVERAGE

As a charting package, Harvard ChartXL receives average marks for its data-handling interface (also used by Stanford Graphics), but its spreadsheet capabilities score well below the median. The only operation you can perform easily is transposing data. Though the program correctly began our moving-average chart, rather than leaving a gap where we had missing data, it incorrectly connected the points.

Depending upon your needs, you may find ChartXL's single-page metaphor a limitation, though you can *associate* multiple spreadsheets with a single graph. But ChartXL's simplicity makes for easy navigation: Instead of multiple MDI windows, you see the chart, the data, or both in a split-screen view. And though it lacks presentation tools, ChartXL has strong OLE support (both container and server), and the graphics filters it shares with Stanford Graphics offer a good selection of user-definable parameters.

If you need the most sophisticated analysis tools available in a charting package for statistical and technical data, check out Stanford Graphics or Delta-Graph Pro. But for most charting needs,

including business charting and analysis, ChartXL strikes the right balance among chart selection, ease of use, and price.

Harvard ChartXL 2.0. List price: \$149. Requires: 486-based PC or better. 8MB RAM, 5MB hard disk, Microsoft Windows 3.x or later. Software Publishing Corp., Santa Jose, CA; 800-336-8360, 408-537-3000; Web, <http://www.spc.com>. Circle 459 on reader service card.

Lotus Development Corp.

Lotus 1-2-3 Release 5 for Windows 3.1

Lotus 1-2-3 Release 5 for Windows 3.1 may have a lot of strengths, but charting isn't one of them. Not only does it offer the smallest selection of chart types in this group of products, but this \$329 spreadsheet package gives you limited control over those features it does offer, and it performs sluggishly.

During chart creation, Lotus 1-2-3 introduces Chart Assistant. In actuality, this feature is nothing more than a dialog box that tells you to select your data range and draw a bounding box for the graph. Like Excel's, Lotus 1-2-3's chart gallery gives you thumbnails that depict the different chart subtypes but lack explanations.

We couldn't even come close to creating several kinds of charts—including doughnut, linked pies, and moving-average lines—with Lotus 1-2-3. The program's inability to handle our combined time/date data series annoyed us as well: It understood the data, but it just didn't offer a combination number format.

In our pie chart, Lotus 1-2-3 erroneously assumed that text in the upper-left-hand corner of pie-chart data was a label for the first series—even though the "data" was column labels. So we simply went back and excluded it from the data range. Unlike Excel, however, Lotus 1-2-3 properly left holes in the line chart when it encountered missing data.

NOT EXACTLY 1, 2, 3

Scientific and technical charters won't find much to like in Lotus 1-2-3, unless they need its full-fledged spreadsheet capabilities. Not only does it lack any scientific or technical chart types, but like Excel, it doesn't always maintain the visual accuracy of the charts. You can't force it to preserve the aspect ratio in a scatter chart either.

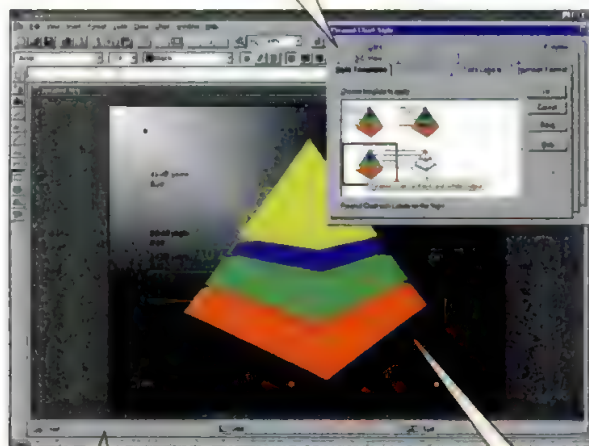
You adjust chart elements in Lotus 1-2-3 via right mouse button and drop-down menus. The program lets you attach axis titles and labels to specific cells in a worksheet. It also supports two footnote fields per chart. But these pluses aside, Lotus's labeling controls are pretty pathetic. Though axis labels automatically stagger and wrap, we couldn't rotate them

SUITABILITY TO TASK

Harvard ChartXL

	Power	Ease
Business charting	Excellent	Excellent
Technical charting	Excellent	Excellent
Presentation and integration	Excellent	Excellent
Visual data analysis	Good	Excellent

Style templates make it easy to reformat your charts quickly.



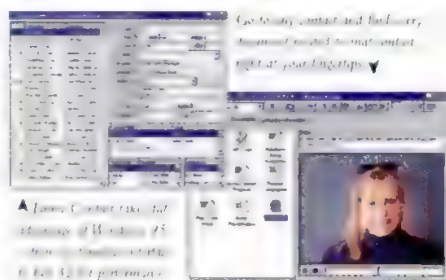
The program restricts you to a single chart per file.

ChartXL beats the rest of the pack in its selection of business charts.



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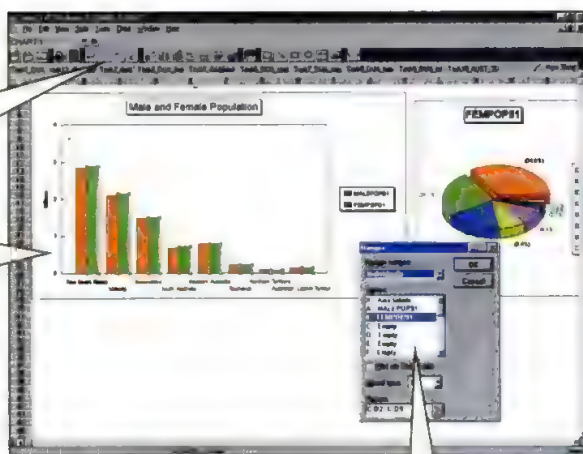
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 CIRCLE 383 ON READER SERVICE CARD

Lotus 1-2-3 offers a basic selection of business chart types, which you can quickly apply from the Smarticon bar.

The ability to stagger labels is one of Lotus 1-2-3's few formatting tricks.



Each data series and label is attached to a user-definable range in the worksheet.

to fit on our dense stock chart. And, disappointingly, the program follows the "when in doubt, truncate" rule of fitting labels. Like Excel, it treated our date/time data as categorical, so we couldn't rescale it to fit better; we could only tell it to drop every n^{th} label. And as it handles data categorically, it can't change the density of the tick marks without changing the data.

You can manipulate all the basic formatting attributes—such as font and size, color, and line weight—but we also found the program noticeably sluggish when it altered these properties on a large chart.

MAKING CHANGES

As you'd expect, Lotus 1-2-3 automatically updates existing charts as you add new data to your data set, though you usually have to respecify the data range if the new data is not within the existing range. Updating missing data wasn't as easy as we would have liked, because Lotus can't search across blank cells. Nor does the program offer a way to interpolate data between two data points. It can only perform the numerical auto-fill that we're accustomed to seeing in our spreadsheets.

Lotus 1-2-3 makes changing chart types as simple as selecting a new one from the gallery. But changing the series order within a chart proved more difficult—we had to redefine the data ranges. You can easily select overlay chart types, though.

The program's marginal linking and embedding features work with Micrografx Charisma and Word for Windows 7.0 but not with PowerPoint 7.0. Other than copying and pasting, these features provide the only way to move charts into other pack-

ages. Lotus's print features proved slightly more adequate: It previewed hard-copy output properly and produced acceptable black-and-white as well as color printouts.

If you already use Lotus 1-2-3 and find that your blood pressure rises every time that the program's charting capabil-

ities fall short, you'll definitely benefit from one of the more comprehensive, effective charting packages profiled in this roundup.

Lotus 1-2-3 Release 5 for Windows 3.1. List price: \$329. Requires: 386-based PC or better, 4MB RAM, 11MB hard disk, Microsoft Windows 3.1 or later, DOS 3.3 or later. Lotus Development Corp., Cambridge, MA; 800-343-5414, 617-577-8500; fax, 617-693-4551; Web, <http://www.lotus.com>. Circle 460 on reader service card.

Microsoft Corp.

Microsoft Excel for Windows 95

When Microsoft first integrated the Wizard concept into its charting module, it streamlined a once painful process. Unfortunately, it hasn't updated the charting module in its \$339 Microsoft Excel for Windows 95, so it has missed the opportunity not only to expand the module's capabilities but to add necessary usability improvements.

Excel offers a basic set of charts that most business users will find sufficient, including less frequently used selections such as doughnut and radar charts. You can easily create simple charts: Just select your data range, click on the chart Wizard, and then choose data location, chart type, and chart elements from the subsequent screens. Charts may appear on a separate workbook page or float on top of a spreadsheet page. You may chart data from noncontiguous ranges and base charts on named ranges.

WHERE IT EXCELS

As you'd expect from a spreadsheet, Excel offers a far broader set of tools to work with cell-based data—including complete financial, statistical, and technical functions—than standalone charting packages do. But except for the new Data Map tool, based on MapInfo's geographical information systems technology, Excel lacks devices for visually analyzing data—so it can't successively refine the presentation of data to enhance the patterns in it. Excel does allow you to apply a variety of curve fits and moving averages to your data, though. And we easily filled in the missing values in our time series with Autofill, which linearly extrapolated data from previously selected values.

You can change elements and add new data to an existing chart just as easily. To change chart formatting, click on the chart until you've selected the desired element; then make changes via the property dialog boxes or context menus (which you access from the right mouse button). Excel offers a broad selection of number formats that you can apply directly to the chart axis rather than to the underlying data in the spreadsheet. The program also provides sufficient control over the important element formats—colors, font attributes, axis placement, titles, and legends—and lets you use multiple columns/rows of data for your labels. And you can

SUITABILITY TO TASK

Microsoft Excel for Windows 95

	Power	Ease
Business charting	Good	Good
Technical charting	Fair	Fair
Presentation and integration	Fair	Good
Visual data analysis	Fair	Fair

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SUMMARY OF FEATURES

Charting Software



■ YES ■ NO

Products listed in alphabetical order

DeltaGraph Pro 3.5

Harvard ChartXL 2.0

Lotus 1-2-3 Release 5 for Windows 3.1

Microsoft Excel for Windows 95

Quattro Pro 6.0 for Windows

Stanford Graphics 3.0

Price	\$195 (list)	\$149 (street)	\$329 (list)	\$339 (street)	\$395 (list)	\$149 (list)
Business Functions						
Bubble (2-D/3-D)	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Candlestick	■	■	■	■	■	■
Gantt	■	■	■	■	■	■
Geographical map	■	■	■	■	■	■
Group map (2-D/3-D)	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Pictographs	■	■	■	■	■	■
Linked/proportional/doughnut pies	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Pyramid	■	■	■	■	■	■
Ribbon	■	■	■	■	■	■
Spider	■	■	■	■	■	■
Step	■	■	■	■	■	■
Time line	■	■	■	■	■	■
Statistical Functions						
Box-Whisker (2-D/3-D)	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Column error	■	■	■	■	■	■
Curve fitting	■	■	■	■	■	■
Exponential/Hyperbolic	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Logarithmic/Polynomial	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Cyclical/Spline/Surface	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
User-defined	■	■	■	■	■	■
Error bars	■	■	■	■	■	■
Graph from equation	■	■	■	■	■	■
Histogram	■	■	■	■	■	■
Graph moving:						
Averages	■	■	■	■	■	■
Variances	■	■	■	■	■	■
Star	■	■	■	■	■	■
Technical						
Contour (2-D/3-D)	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Paired x, y	■	■	■	■	■	■
Parametric curve/surface	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Polar (2-D/3-D)	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Spectral	■	■	■	■	■	■
Surface	■	■	■	■	■	■
Trajectory	■	■	■	■	■	■
Vector (2-D/3-D)	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Data Handling and Analysis						
Import formats:						
.CSV/Delimited ASCII	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
.DIF/.WK1	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
.WK*/.XLS	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Database queries	■	■	■	■	■	■
OLE container/server/automation	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Presentation and Formatting						
Grid formatting						
Tick marks inside/outside/across	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Label formatting:						
Staggered/Rotated/Angled	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Chart export formats:						
.BMP/EPS	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
.GIF/PCX	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
.TIFF/WMF	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
User can add custom charts to gallery	■	■	■	■	■	■
Annotation:						
Arrow	■	■	■	■	■	■
Notes	■	■	■	■	■	■

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Polygon tool	YES	NO
Fountain fills	YES	NO
Center and repeating arrows	YES	NO
Hyperlinks	YES	NO
Dynamic print preview	YES	NO
Multiple shadows	YES	NO
Thesaurus and Type Assist	YES	NO
Live auto-line routing	YES	NO
Script editor	YES	NO
Number of color models supported	8	2

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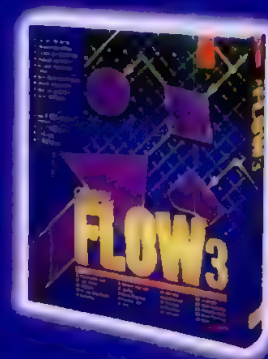


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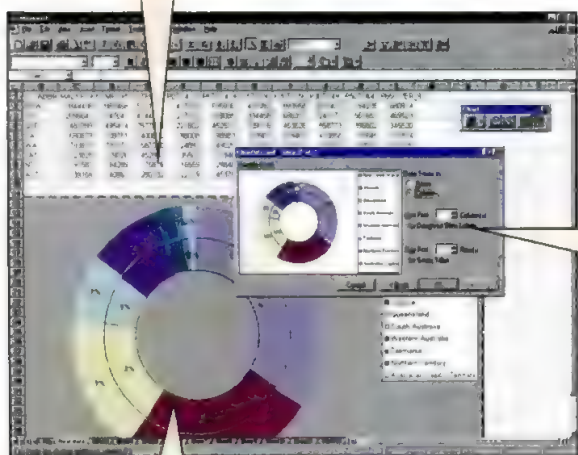
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Excel's Chart Wizard gives you live feedback as it helps you configure your chart.

The program offers a relatively basic set of chart types. Doughnut is about as exotic as it gets.

annotate charts by adding arrows, callouts, and notes.

WHERE IT DOESN'T

Overall, though, Excel puts on a lackluster show. Except for the package's robust data import and export functions, Microsoft still needs to do something better in each phase of its program. Take chart creation, for example. We wanted to create a simple line chart based on a large time-series data set. With the Chart Wizard, we selected a chart "subtype" from one of the simple thumbnails, which had absolutely no accompanying explanation. Which type performs smoothing? Your guess is as good as ours.

Excel suffers from an even more serious weakness: It treats all data as categorical. Thus, when creating a surface chart, the Wizard prompted us to indicate whether our data series appeared in columns or rows—even though surface data usually comes not in labels but in a matrix with the *x* and numerical data in the first column and top row, respectively.

And though it's easy to format your charts and save their configurations to reuse (once you've dug through the menus of Autoformat/User-defined/Customize/Add), the program doesn't really extend itself to help you create attractive charts. It knows how to rotate labels only one way—down—and it can't stagger them.

And if it can't fit all the category labels on a chart, it simply doesn't display them. At press time, Microsoft had no comment on these shortcomings.

Excel outputs relatively attractive and readable black-and-white as well as color print, but our PCL

printout emerged with incorrect date formatting along one axis and without the custom offset we had asked for. And we couldn't export the chart in a vector format; disappointingly, only OLE could embed or paste it as a bitmap into PowerPoint.

Excel does the job, but not much more. It provides strictly no-frills charting, so no scientific or technical users need apply—especially if they worry about such issues as maintaining a correct aspect ratio. Dedicated charting users should definitely choose a more advanced, extensive package that offers clear steps for complex needs.

Microsoft Excel for Windows 95. Estimated street price: \$339. Requires: 386-based PC or better, 12MB RAM, 8MB hard disk (Microsoft Windows NT); 386-based PC or better, 6MB RAM, 8MB hard disk (Windows 95). Microsoft Corp., Redmond, WA; 800-426-9400, 206-882-8080; fax, 800-727-3351; Web, <http://www.microsoft.com>. *Circle 461 on reader service card.*

Novell Inc.

Quattro Pro 6.0 for Windows

Among the spreadsheets, the \$395 Quattro Pro 6.0 for Windows, from Novell, takes first place. Though we experienced a few glitches during testing and we think the product could use more intelligence in certain areas, Quattro Pro's broad selection of business charts and variants, combined with satisfactory formatting, results in a more usable business charting tool than its main competitors.

The program makes no attempt to

hold your hand during the chart-creation process. You select your data range, then draw the bounding box for the chart; if you get a "Graph Error: pie, column, or doughnut sum is zero" message, as we did at one point, you must use trial and error to redefine your data ranges. (Quattro Pro read the labels in our noncontiguous selection as data.)

Once you create a chart, you can use Quattro Pro's Graph Gallery to access a broader selection of chart types, both 2-D and 3-D. But you have to decrypt some of the thumbnails. For instance, the line and *x*- and *y*-axis thumbnails are similar, but neither is labeled.

To help you navigate the chart types,

One of Quattro Pro's best features, the Property Inspector, allows the user to select settings without having to select a specific object first.

Quattro Pro offers the Graph Advisor. You specify the parameters and answer such questions as "Do you want to display cumulative data, trends or differences?" and "How simple do you want the chart to look?" The Advisor then looks at the data and returns suggested chart types. But the program breaks down the data poorly anyway, so the suggestions don't really help all that much.

PRETTY GOOD FOR A SPREADSHEET

Quattro Pro provides solid control over chart appearance, including bar width and overlap. You'll also find templates and some color schemes in the Graph Gallery. Quattro Pro lets you use gradient and bitmap fills, in addition to solids and pat-

SUITABILITY TO TASK

Quattro Pro for Windows

	Power	Ease
Business charting	Good	Good
Technical charting	Fair	Fair
Presentation and integration	Good	Good
Visual data analysis	Fair	Good

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Getting Technical: Scientific Graphing Tools

By Barry Simon

Aside from power, the key difference between standard charting tools and tools designed specifically for scientific graphing lies in output. Charts created with business-oriented tools most often end up in presentations, while scientific charts usually accompany reports or technical publications. Packages aimed at the graphing needs of scientists, engineers, and other technical professionals typically don't include speakers' handouts, tools like slide sorters, or extras such as clip art (though programs that support OLE will let you *embed* clip art).

Here we look at seven applications that all focus on the production and output of technical and scientific charts: MathSoft's Axum, Golden Software's Grapher and Surfer, Microcal Software's Origin, Scientific Programming Enterprises' PlotIt, Poly Software International's PSI-Plot, and Jandel Scientific Software's SigmaPlot.

All of these programs are Windows 3.1-compatible and *run* under Windows 95, and several (including PlotIt, PSI-Plot, SigmaPlot, and Surfer) are 32-bit applications. But at this writing, none support such Windows 95 features as long filenames or the Windows 95 Uninstall applet.

AXUM

Thanks to extensive use of tabbed dialogs and button bars, Axum (\$595), from MathSoft (800-628-4223, 617-577-1017), has the smoothest interface of all the programs we saw. Like PlotIt, Axum ships with a version of Design Science's Equation Editor, similar to the Equation Editor that Design Science licenses to Microsoft for use in Microsoft Office. This tool makes adding complex mathematical symbols or mixing Greek and English inside Axum a breeze.

Axum includes about 30 2-D plots and about 20 3-D plots, plus 3-D spline fits, 3-D with projected 2-D contours, and 2-D vector plots. Axum also supports nonlinear and Marquardt-Levenberg nonlinear fitting regressions. It also includes a C-like programming language for the creation of user-defined functions and batch-processing routines.

GRAPHER AND SURFER

Golden Software (800-972-1021, 303-279-1021) offers separate programs for 2-D (Grapher) and 3-D/contour (Surfer) plotting. The rather limited Grapher (\$199) has only four basic plots (line/symbol, bar, function and hi/lo) and lacks even basic polar plots.

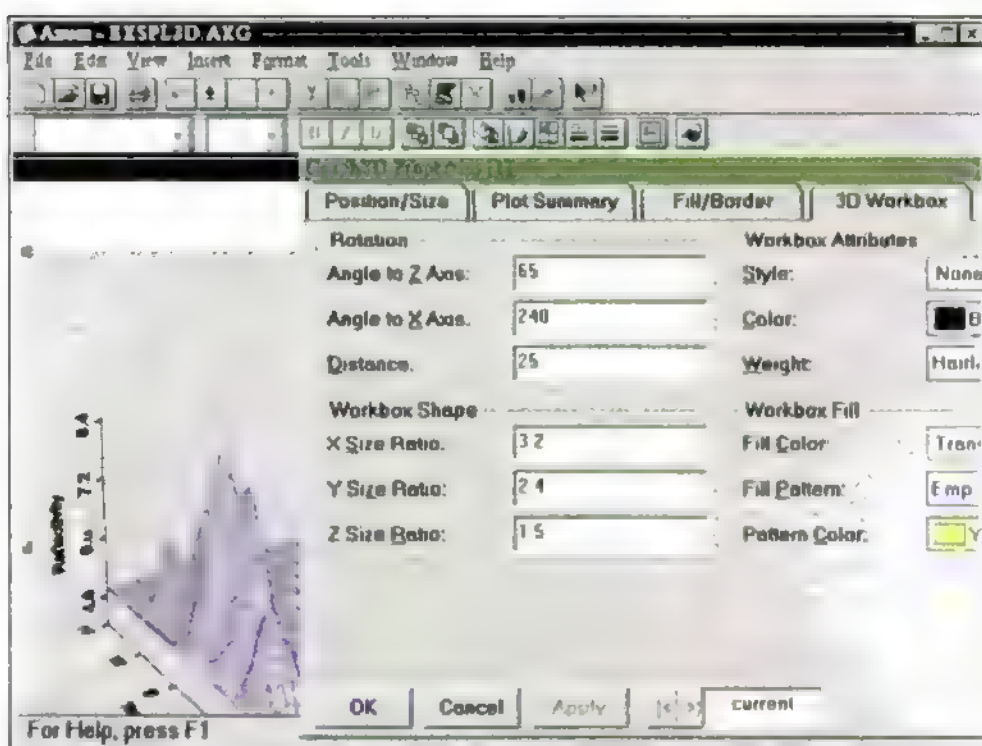
Surfer (\$499), on the other hand, is a far more extensive program. Anyone who needs to produce topographic maps or surface plots and contours will appreciate it. Surfer comes with a full-featured scripting language that you can use directly or via OLE automation; a Visual Basic program, for example, could drive Surfer.

In both programs, you enter Greek and mathematical expressions into text boxes using backslash codes. The list of code options is voluminous. For instance, you can enter summation symbols with limits.

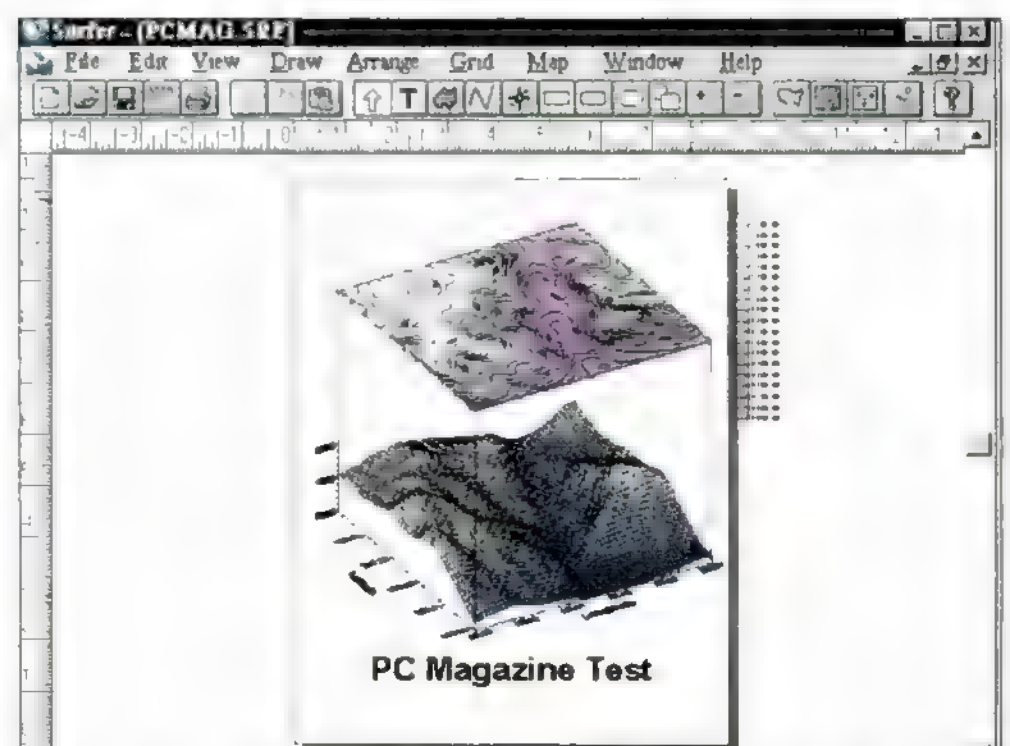
ORIGIN

Origin (\$495; with optional 3-D module, \$545), from Microcal Software (800-969-7720, 413-586-2013), combines the most basic plot types with a high degree of automation. The programming language LabTalk is at the heart of Origin, and you can write scripts or issue commands directly in the language. You can also produce templates for graphs and place buttons that run LabTalk scripts.

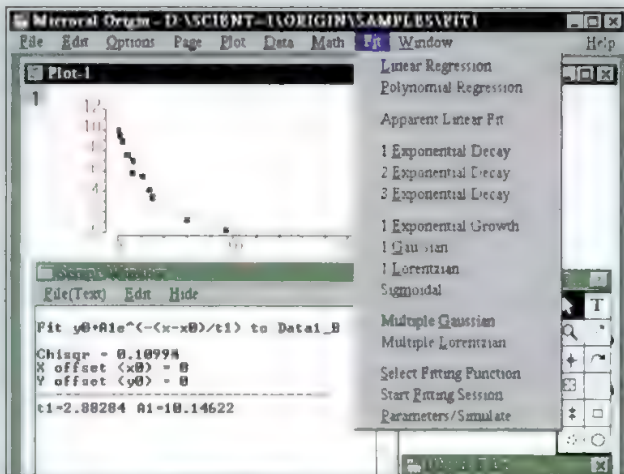
Origin doesn't support OLE 2.0, but it does support OLE 1.0 Paste Link for insertion of editable graphs in programs such as Microsoft Word for Windows. Origin, however, doesn't let you enter



Axum's interface makes extensive use of tabbed dialogs and includes two button bars.



Surfer allows you to display a surface with a projected color-code contour map.



Origin combines a high degree of automation with a large number of curve-fitting options.

annotations or other complex mathematical expressions. Using backslash commands—in combination with buttons that insert commonly used commands—you can enter simple Greek and mathematical symbols in text boxes.

PLOTIT

PlotIt (\$295.95), from Scientific Programming Enterprises (517-339-9859), stands out among these applications for its extensive capabilities—most notably OLE client and server support—and the widest array of unusual chart types, including Pareto and bubble, as well as a handful of useful quality control-specific charts. PlotIt's variety of 3-D graphs—unusual in such scientific packages—even have surfaces with projected 2-D contours.

Like Axum, PlotIt includes a version of Design Science's Equation Editor, so you can easily enter complex text expressions. You can also use backslash codes for quick symbol entry.

With its extensive curve-fitting and statistical tools, a macro language accessible either directly or through external DDE calls, and a wizard to produce simple charts, PlotIt ranks high in the scientific graphing category.

PSI-PLOT

PSI-Plot, \$299 from Poly Software International (801-485-0466), offers a

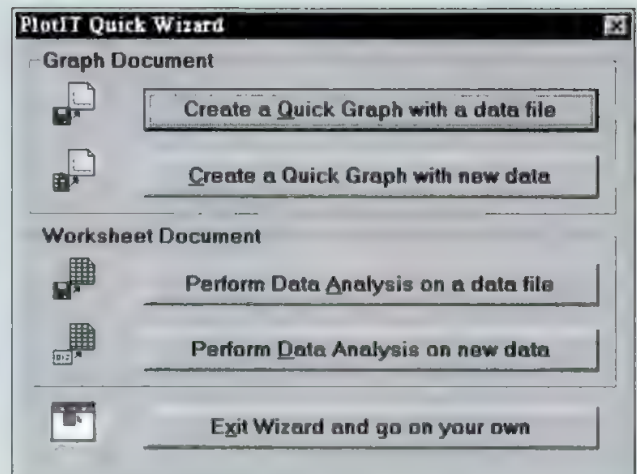
scope of analytical tools that includes spline fits as well as the more standard linear and nonlinear regression tools. It also has analysis of variance (ANOVA), seven kinds of data smoothing, power spectrum analysis using fast Fourier transform, and nine built-in solvers for ordinary differential equations.

PSI-Plot supports 20 2-D graph types, 10 3-D types, and 7 plots defined by functional relations. While it does not support OLE export, it will export to a wide variety of file formats, including AutoCAD, CGM, .DBF, EPS, .GIF, HPGL, .PCX, and TIFF.

PSI-Plot has minimal abilities to add special symbols to charts: You can't enter complex mathematical expressions, such as a summation sign, with limits underneath. Though symbol fonts can be mixed with roman text in a text object, you have to use awkward backslash commands, and you can use only symbols from Microsoft Windows' Symbol font.

SIGMAPLOT

A good product with an effective interface, SigmaPlot (\$495), from Jandel Scientific Software (800-452-6335, 415-453-6700), offers strong OLE support and an extensive Transform language. The interface includes a button bar, tool palettes, and a set of buttons for graph type. A Notebook feature stores multi-



PlotIt includes a Quick Wizard for rapid production of simple graphs.

ple data sets and graphs in a single outline.

Because SigmaPlot is an OLE client, you can use an OLE-based equation editor to insert complicated mathematical expressions. But SigmaPlot doesn't ship with an OLE-based equation editor, and the built-in tools for symbol entry are weak. SigmaPlot includes charts geared to scientists and engineers, but it doesn't offer some of the more esoteric charts, such as Smith charts and built-in surface charts with shadowed contours.

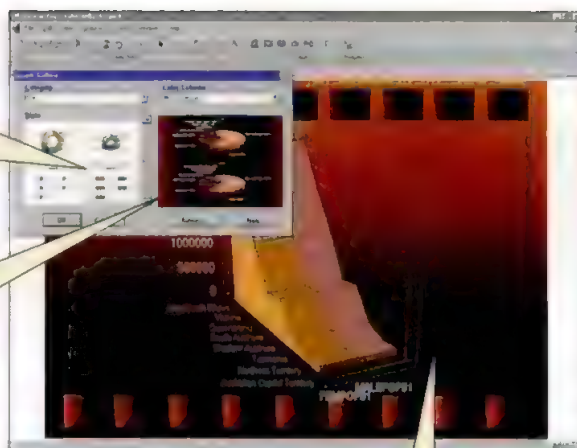
SigmaPlot also includes a "transform language" that can specify custom functions and define sophisticated fitting algorithms handily.

OTHER OPTIONS

There are alternatives to these scientific plotting packages. Symbolic math packages such as Macysma, Maple, and Mathematica and other comprehensive math packages (Mathcad and Matlab, for example), let you produce two- and three-dimensional graphs. And statistical packages SPSS and Statistica have long included strong charting modules. Ultimately, though, if you have to produce printed output, often need to modify charts and add legends and multiple axes, and want a wide array of chart types, take a look at one of the packages specifically dedicated to the production of scientific charts.

Like Excel and Lotus 1-2-3, Quattro Pro sticks to business chart types, but it offers a broader selection of variants on the basics.

Using your data, the program's Graph Gallery gives previews of the chart types and color schemes.



The Gallery also includes presentation-like backgrounds and templates.

terns: We simulated a pictograph, for example, with a tiled bitmap fill.

All Quattro Pro's default font-size settings are huge, so you'll want to tweak the axis and label formatting. You can stagger labels up to three rows deep or truncate them to a user-specified length, and the program can automatically calculate how many labels to skip so they don't overlap. As with Excel, you can apply numeric formatting on the chart and on the data sheet. Unfortunately, Quattro Pro doesn't rotate labels, and the inability to control tick-mark density inhibited the presentation of our time-series chart.

One of Quattro Pro's nicest features is the Property Inspector. While it gives you access to the same settings a mouse menu does, you don't have to go through the process of selecting a specific object first.

While rather agile overall, Quattro Pro had trouble handling charts that used a large data series and a 30-day moving average. And the program may inconvenience some users by replacing the existing charted series (though not the underlying data) with moving averages as well as generating linear and exponential curve fits.

Quattro Pro offers the usual OLE 2 client/server linking and embedding options, and they work well (although we don't like the program's method of temporarily replacing your linked data with NA's if you choose not to refresh the links). Exporting charts didn't perform that smoothly: The .BMP file came out fine, but the CGM version had clipping problems, and we couldn't open the EPS file in several applications.

Similarly, Quattro Pro's print jobs produced erratic results. An area chart

refused to print properly on a LaserJet III-compatible printer—we kept getting time-out errors—and it completely refused to print on an Epson Stylus color printer. The rest of our charts printed fine.

As with the other spreadsheets, Quattro Pro doesn't fulfill the needs of scientific and technical chart users. You can't fix the chart aspect ratio for visual accuracy, and the program lacks some of the intelligence necessary to handle noncategorical data. For instance, the program doesn't offer a simple way to force the chart to use only a right y-axis, and we couldn't set the x-axis intercept.

Despite its weaknesses, Quattro Pro still stacks up better in many ways than the other spreadsheets do. Yet it ultimately can't compare in breadth and depth to standalone charting packages. **Quattro Pro 6.0 for Windows.** List price: \$395. Requires: 386-based PC or better, 4MB RAM, 10MB hard disk, Microsoft Windows 3.1 or later. Novell Inc., Provo, UT; 800-321-4566, 801-226-6800; fax, 801-229-1566; Web, <http://www.novell.com>. Circle 462 on reader service card.

Visual Numerics Inc.

Stanford Graphics 3.0

If you think Visual Numerics' \$149 Stanford Graphics 3.0 seems a lot like Software Publishing Corp.'s Harvard ChartXL, you're right. SPC bought the code from Visual and made it more robust and easier to use. So why choose Stan-

ford? If you need more data analyses and an approach that is slightly more presentation-output-based, you may want to consider Stanford; otherwise, Harvard ChartXL is a better implementation. Stanford's 16-bit application runs on Windows 3.1, and its native 32-bit application (available in an otherwise identical release, 3.0c) runs on Windows 95 and Windows NT.

In Stanford Graphics, you associate ranges of data to graph elements with the Range Highlighter. To construct a Box-Whisker diagram, for instance, we set ranges for elements such as Box Percentiles, Box Values, Test Name, and Test Values. And when you need to redefine your ranges frequently, the program's Variables feature lets you easily define and associate named ranges with elements. Unlike DeltaGraph Pro, in which you must type in the full range name to make this association, you can pick named ranges from Stanford's list.

When you select Add Graph or its icon, the program offers a list of chart types from which to choose. Then you can pull up the Gallery, where you find both thumbnails and concise, customizable de-

SUITABILITY TO TASK

Stanford Graphics

	Power	Ease
Business charting	Good	Good
Technical charting	Excellent	Good
Presentation and integration	Excellent	Good
Visual data analysis	Excellent	Good

scriptions of the different plot types. If you haven't selected a spreadsheet, you may also opt to generate a graph from sample data.

Though Stanford offers a broad selection of chart types, it doesn't match Harvard ChartXL in business charting. Stanford lacks some unusual but increasingly popular chart types—such as doughnut and pyramid—as well as tools for analyzing business data, including moving averages.

Stanford does provide excellent formatting controls, though. You can stagger, wrap, and slant axis labels or display every n^{th} label. We especially liked the option that forced it to display first and last labels, a feature found in ChartXL as well. Like DeltaGraph Pro and ChartXL, Stanford provides a good selection

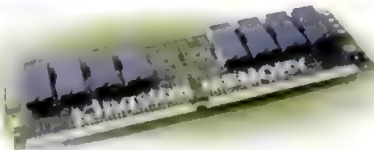


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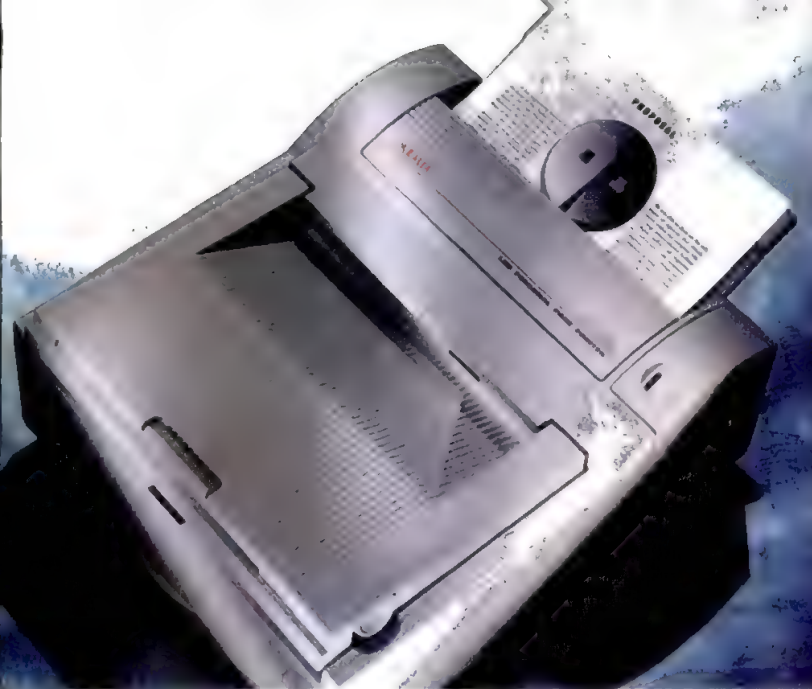
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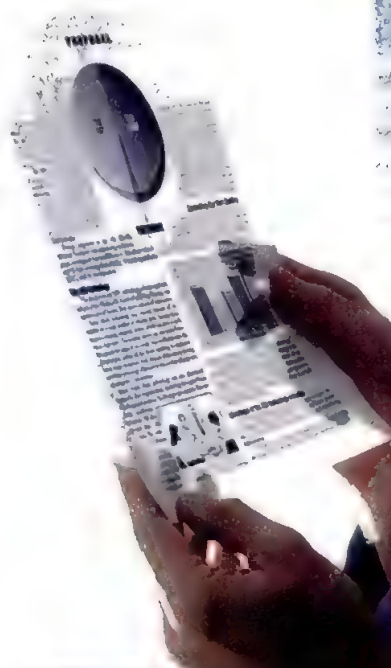
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of fill types, including gradients, patterns, and pictures. With full control over line styles and weights, fonts, and every other necessary presentation function, you can offset the axes by simply dragging them to the desired location, and you can preserve the chart's aspect ratio by setting axis lengths.

Because Stanford is a presentation package, it offers master layout formats and the ability to create slide shows, as you can with DeltaGraph Pro. But like DeltaGraph Pro, Stanford is burdened by standard presentation features that lack refinement and extensibility.

For analysis, however, Stanford offers several handy tools (also available in ChartXL but with fewer options). The Data Explorer reports the x-, y-, and z-values of the point under the cursor, as well as its location in the spreadsheet. If you drag the point, the program will update the value in the sheet. Because Stanford Graphics generates a data set for any curve fits you apply—the program offers the broadest selection in this roundup—the data cursor works on these as well. The Equalizer lets you play with regression parameters. Our favorite feature, Formula Visualizer, generates graphs of curves

and surfaces, and associated data sets, from user-defined equations. This function provides a great method of generating ideal plots for comparison with real-life data.

The program's output, both hard copy and graphics file export, satisfied us for the most part; both performed about average. The program's OLE links performed flawlessly, with Microsoft Word for Windows as well.

Despite all this power, Stanford uses confusing methods for charting, especially when compared with the otherwise similar ChartXL. In Stanford, you navigate the spreadsheets differently from the slides' charts, and you need

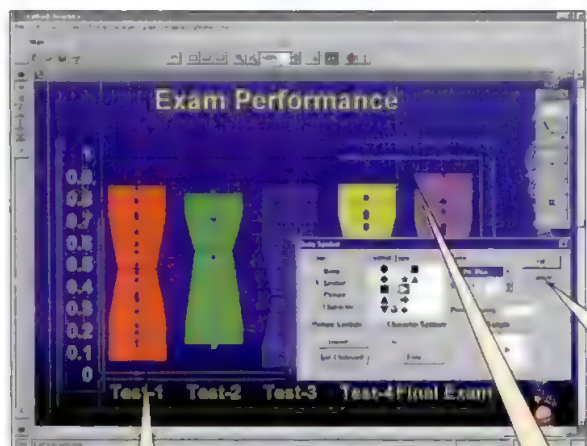
to jump too often between functions. Also, you won't find explanations of the many ambiguous dialog box options in the help system.

If you need to create presentations with statistical content or serious data analysis, Stanford Graphics probably offers the shortest route to your destination. For analyzing business data or simply generating charts, Harvard ChartXL's feature set plus its more approachable interface makes it a more suitable choice. □

Stanford Graphics 3.0. List price: \$149.

Requires: 386-based PC or better, 4MB RAM, 5MB hard disk, Microsoft Windows 3.1 or later, DOS 5.0 or later. Visual Numerics Inc., Houston, TX: 800-729-4723, 713-784-3131; fax: 713-781-9260; Web: <http://www.vni.com>. Circle 463 on reader service card.

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The product offers a broad set of chart types, with an emphasis on the statistical and technical.

Stanford Graphics is really a presentation package for those who need strong charting and data analysis tools.

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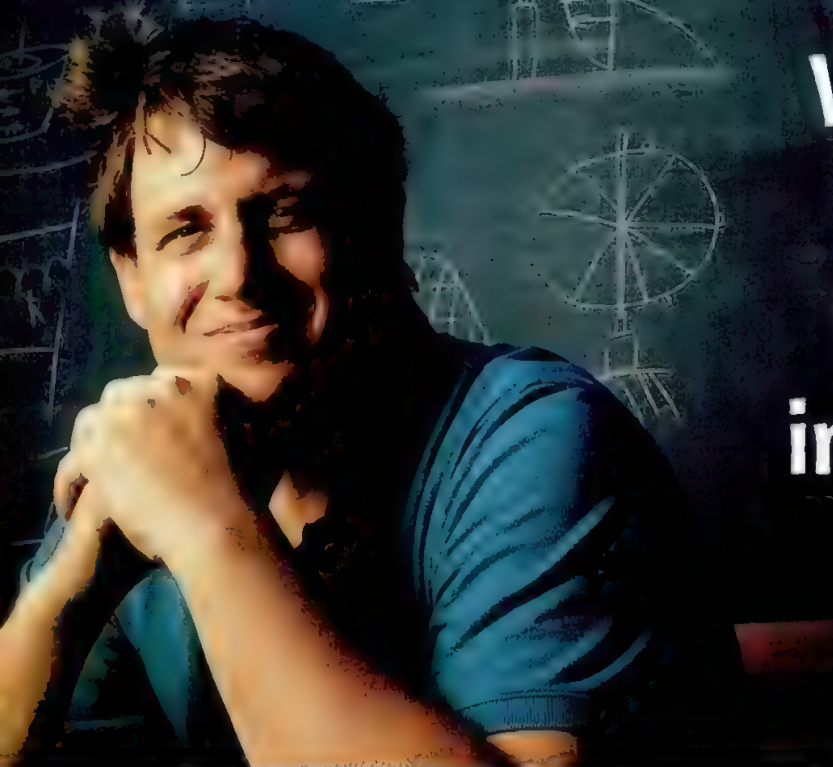
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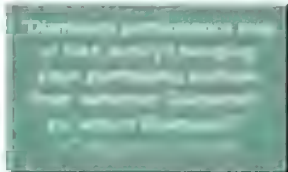


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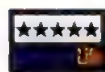
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PC Tech

THE DEFINITIVE GUIDE TO PC TECHNOLOGIES & TOOLS

Prepackaged Power II: More New OCX Controls

Five new OLE custom controls offer charts, spreadsheets, and object browsing.

By Stephen W. Plain

In our last issue (January 23, 1996), we reviewed five of the first 32-bit OLE custom controls (OCXs) to ship after the launch of Microsoft Visual Basic 4.0. Here we offer reviews of an additional five that have since become available.

Charting controls designed to help you add business graphics and charts to your applications are heavily represented in our selection. Three new charting components—Chart FX for

Windows 3.0 from Software FX, Visual Components' First Impression 2.0, and Pinnacle Publishing's Graphics Server 4.0—offer a broad selection of strong functionality. Of course, they also vary in their particular strengths. For example, Chart FX provides an intriguing real-time chart type for creating scrolling financial applications, while First Impression offers unmatched control over angling and lighting effects in 3-D charts. For special applications, Graphics Server provides certain esoteric chart types for financial analysis not



Inside OLE automation interfaces, page 239

IN THIS SECTION



TUTOR The Windows 95 shell may seem like just a glorified Program Manager, but many of its slickest features are actually OLE objects. Jeff Prossie explains how Windows 95 uses OLE interfaces to do some tricks that the old Program Manager could never perform. *page 231*



INSIDE WINDOWS 95 In the fourth in our series on OLE, we look at OLE Automation, a powerful, developer-centric feature that lets you create programmable objects that other applications can access. *page 239*



POWER PROGRAMMING A real-life example of partitioning an application's tasks that can be performed on the client side from those that are best performed on the server. Paul Bonner shows how the Remote OLE Automation facility provided in the Enterprise Edition of Visual Basic 4.0 makes it possible. *page 247*



INTERNETWORKING CGI scripts can change your Web page from a static, stateless entity into a truly interactive medium. Sean González discusses the pros and cons of implementing CGI scripts and their alternatives. *page 263*

ALSO IN THIS ISSUE PC Solutions includes advice for customizing the tips displayed in Windows 95's Welcome screen, getting 32-bit hard disk access on systems with CD-ROM drives, and protecting your documents from the new Winword.concept virus. *page 269*



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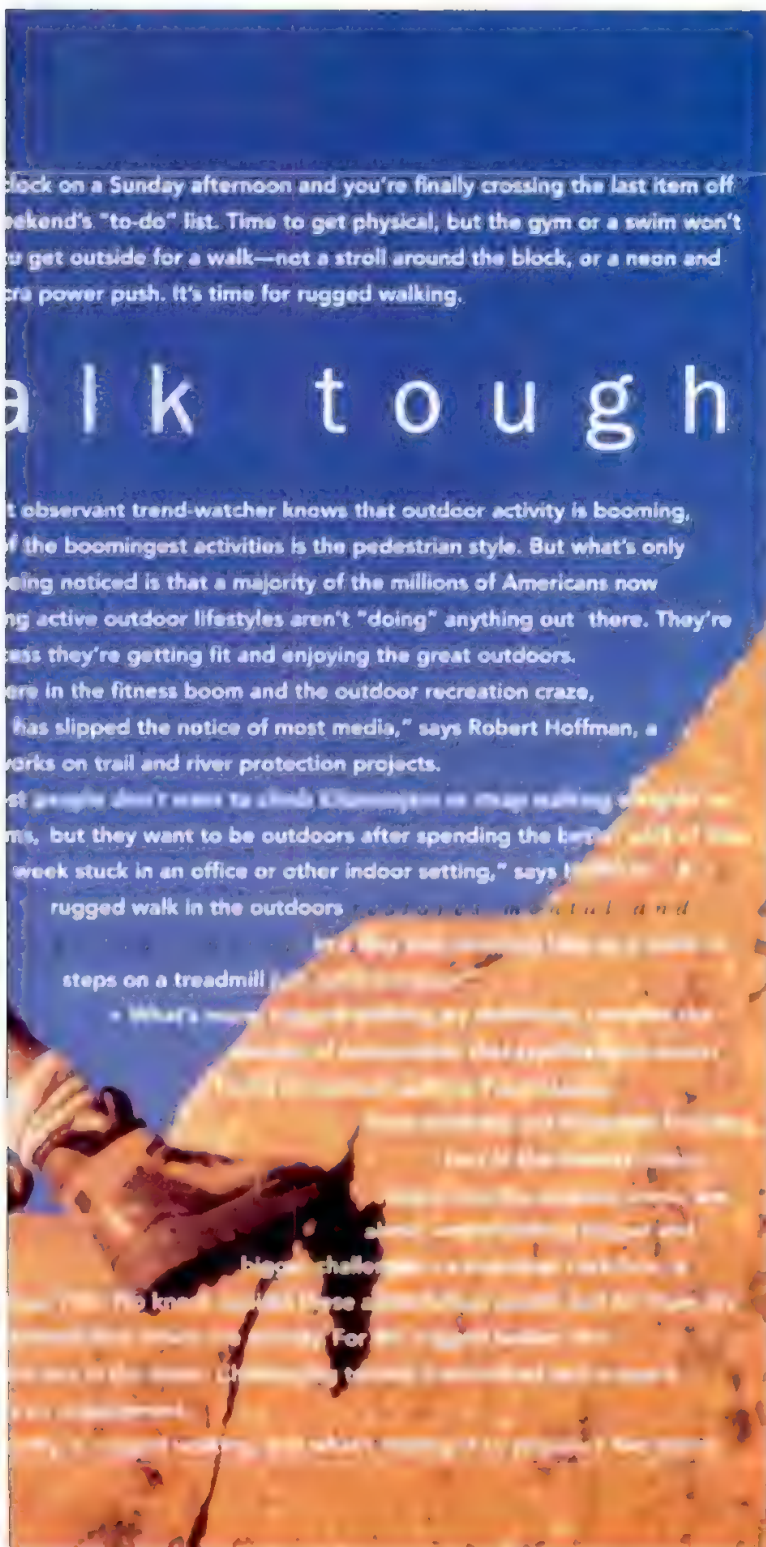
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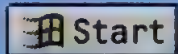


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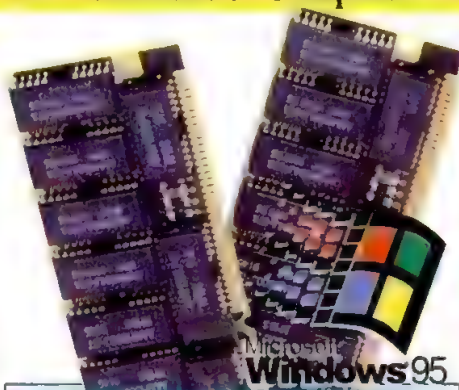
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supported by the others. All three provide both 16-bit and 32-bit OCXs, and Chart FX and Graphics Server include VBXs and DLLs as well.

We also include Visual Components' Formula One 3.0, a highly sophisticated grid control that gives you, in essence, a Microsoft Excel-compatible spreadsheet complete with math functions that you drop into your application. Its Workbook Designer module uses a familiar spreadsheet interface with a toolbar to help you perform formatting operations at design time. Formula One also integrates closely with the company's First Impression charting control, offering a strong foundation for building complex business applications.

Finally, Apex Software VBA Companion 1.0 is not an OLE control but a powerful OLE object browser. It queries the Registry to display all the OLE objects on your system, which it then displays in a clear expandable-collapsible tree format. It also provides a coherent way to browse their properties, methods, and events. In addition to being a great Visual Basic add-on, it's ideal for programmers working with the exposed objects in OLE-enabled productivity applications.

In future issues of PC Tech, we'll continue to feature new OCXs as they appear. Upcoming reviews will cover browser and communications controls for developing intranet and TCP/IP applications. Later in the year, we'll also tackle data-access controls aimed at client/server development.

Software FX Inc.

Chart FX for Windows 3.0

ALL REVIEWS BY STEPHEN W. PLAIN

Chart FX, from Software FX, is a flexible charting tool designed for a variety of development environments in addition to Visual Basic 4.0. The product ships with VBX, 16-bit OCX, and 32-bit OCX controls as well as a DLL that provides identical functionality. The vendor promises compatibility with Borland C/C++, Borland Delphi, Gupta SQLWindows, Microsoft Access, Microsoft C/C++ 7.0, Microsoft

Visual C++, and the Windows 3.1 SDK. Chart FX sells for \$348.

control we tested provides a good solution for general-purpose charting requirements. Chart FX covers the basics well with a nice selection of 2-D and 3-D chart types, including open-hi-lo-close, surface, doughnut, and pareto charts. It also lets you define the shape of three-dimensional columns by specifying the number of vertices on the perimeter of the column or by selecting conic columns that rise to a point. Chart FX includes a special real-time chart type that lets you smoothly scroll real-time data for financial applications.

When you place the Chart FX control on a form, it immediately displays sample data to give you a feel for what it will look like. Chart FX lets you work extensively with the chart at design time and reflects your changes as you make them. The control's property sheet contains 11 separate tabs full of properties. These are slightly overcategorized, however, and can sometimes be a little difficult to locate. For example, legend colors are in the Colors tab, but you must switch to the Elements tab to define the grid-line colors. But once you get used to the dialogs, you begin to realize Chart FX's true flexibility and usefulness.

Chart FX lets you define the rotation and elevation of your 3-D chart as well as the depth of its z axis. There are no fancy lighting features however; you can simply turn shadows on or off. The 3-D View dialog gives you a nice way to adjust the angles: You slide two "marbles" that represent viewing points around two perpendicular rings on a sphere. A preview to the right displays the changes in real time. Although this dialog makes it easy to adjust the 3-D viewing angle, some additional lighting resources would make the 3-D appearance a bit more realistic.

What few limitations Chart FX has in design mode are made up for

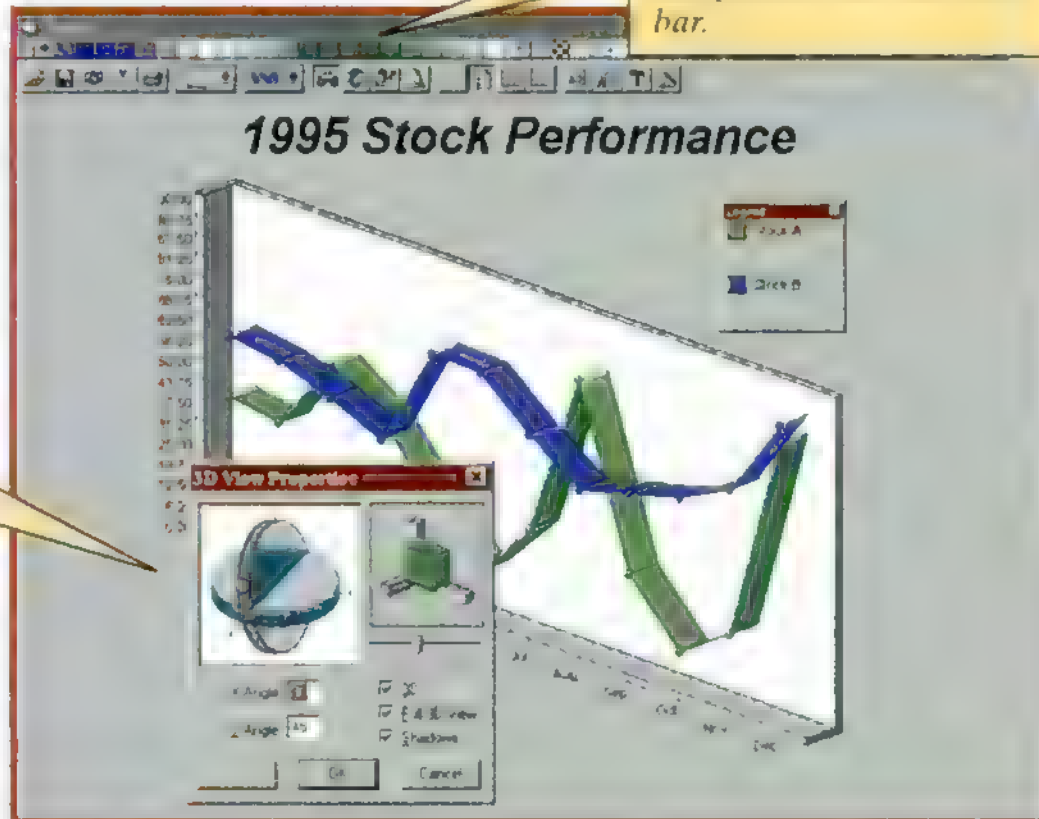
END USERS can quickly customize the chart at runtime using the palette bar, pattern bar, and toolbar.

3-D VIEW PROPERTIES offer a novel way to adjust the rotation and elevation of your 3-D charts.

Visual Basic 3.0 and 4.0, Microsoft Visual C++, and the Windows 3.1 SDK. Chart FX sells for \$348.

The 32-bit OCX con-

CHART FX



with its flexible runtime elements. You can choose to enable the standard toolbar, pattern bar, and palette bar tools to give your end users full ability to manipulate the chart as they view it. The toolbar lets them set text formats, graph types, and 3-D view, as well as switch between 2-D and 3-D modes, copy graphs to the clipboard, print, save, and more. Using the scrolling color bar and palette bar, users can drag colors and patterns to any area of the chart to change its appearance. One important runtime feature, the Data Editor, is conspicuously absent in design mode, though. Using the Data Editor, which is available from the toolbar, the user can plug in new values for the chart at runtime. To preload a chart with specific values at design time, however, you must set the control's Value property array through code.

Setting values and modifying properties from code is a little more complicated than it need be, probably due to compatibility issues imposed by the many supported development systems. Before you modify properties (including data values), you must call the OpenData method to open a communications channel to the control, then close the channel when you're done setting the properties. Depending on the item you're changing, you may have to open different data channels. Seven different constants are provided in the control's declarations module that you pass with the OpenData method to open different types of channels.

Chart FX comes with a very generous selection of example projects for several of its supported environments, including Borland Delphi, the supported C++ programs, SQLWindows, and Visual Basic. The manual is comprehensive and illustrates the appropriate syntax of all library calls for each of the various environments, but it's unnecessarily difficult to look up OCX properties, methods, and events quickly.

Despite a few such warts in the product's presentation, Chart FX is a useful control and comes in enough flavors to work in any development system you choose.

Chart FX for Windows 3.0. List price: \$348. Software FX Inc., Boca Raton, FL; 800-392-4278; <http://www.vbxtras.com/~softwarefx>. Circle 465 on reader service card.

Visual Components

First Impression 2.0

First Impression, Visual Components' \$249 OCX charting control, is a flexible and easy-to-use component that should meet any programmer's charting needs. It provides a broad range of 2-D and 3-D chart types and uses a straightforward interface that won't slow you down.

The package includes 16-bit and 32-bit OCXs, both of which give you a choice of 14 2-D and 12 3-D chart types in the Gallery.

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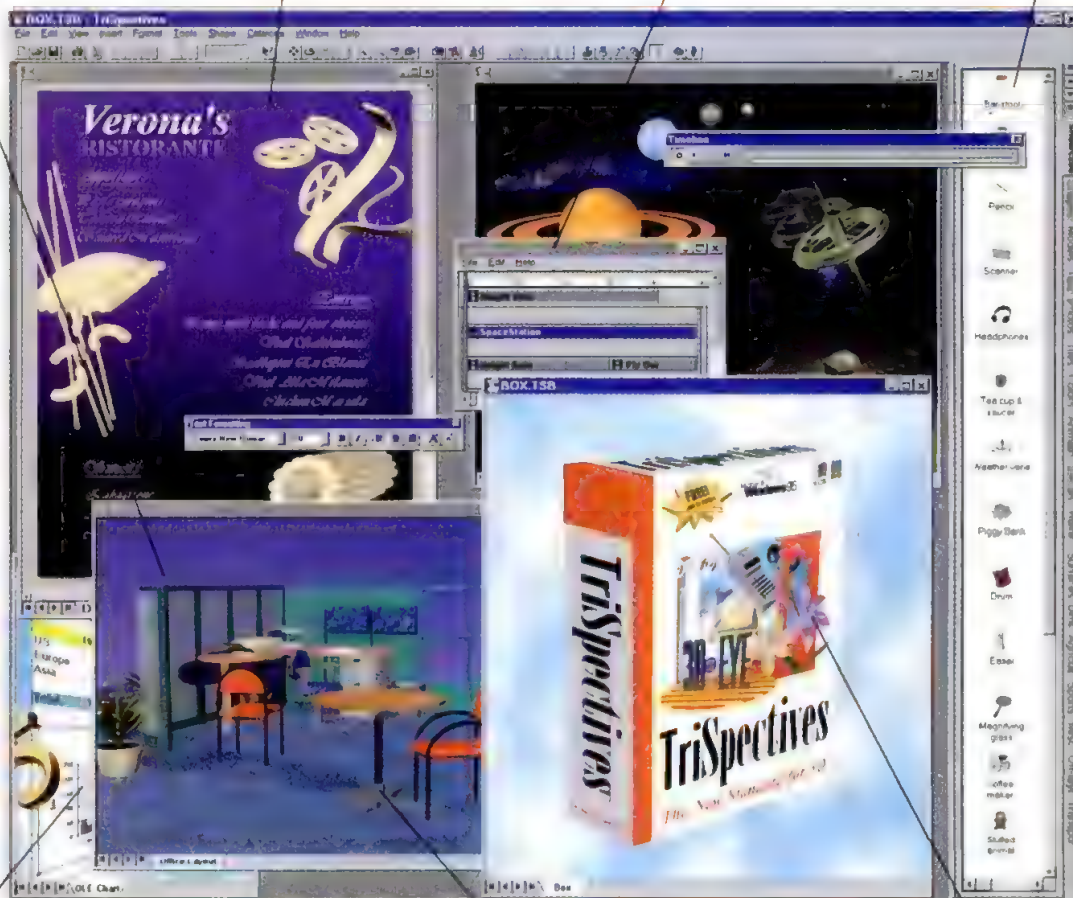
Stanford Dahl, BYTE Magazine, October 1995

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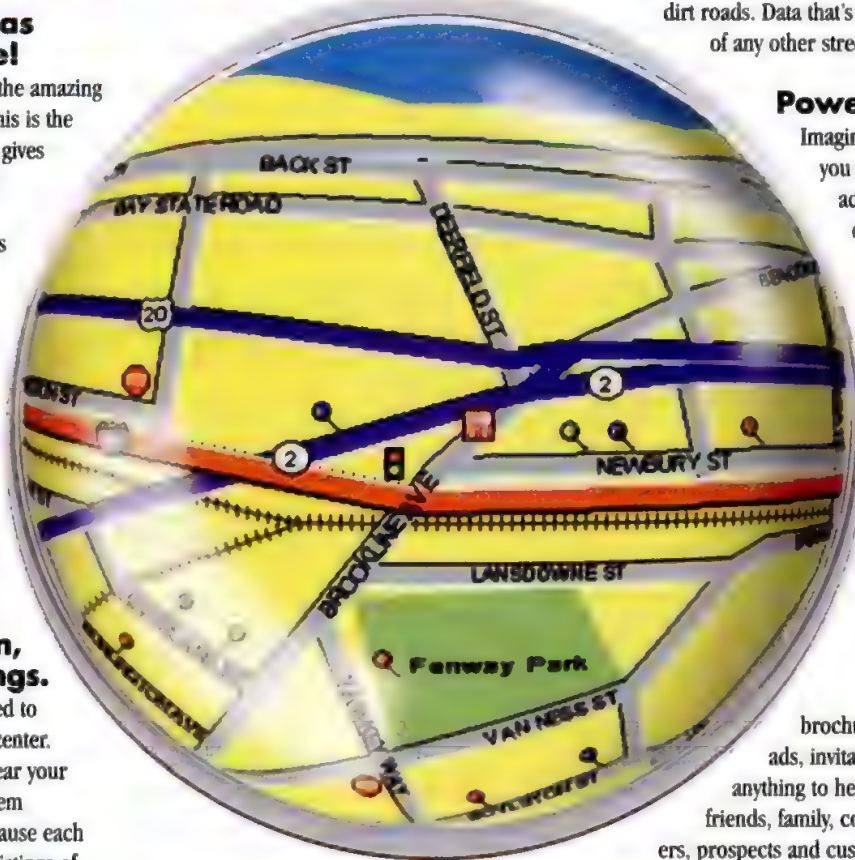


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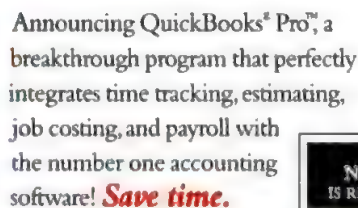
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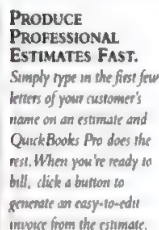
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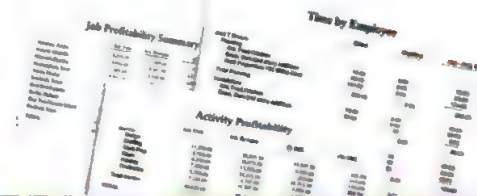
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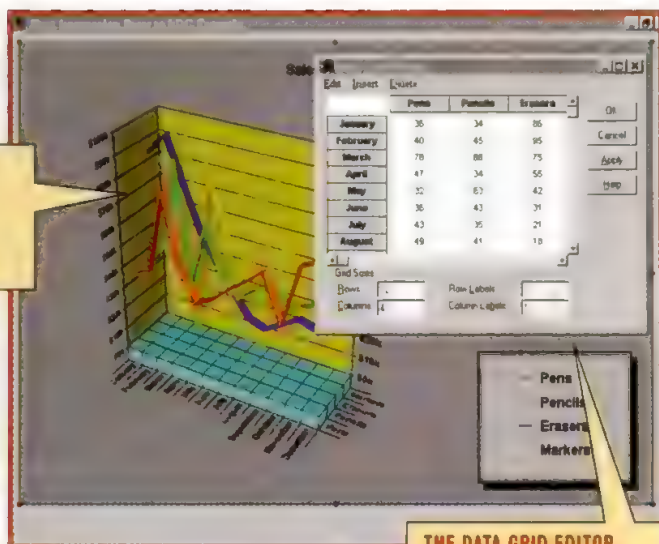
Chart creation is an easy process. After you drop a First Impression control on a form, you can simply right-click and choose the resulting context menu's Wizard option, which steps you through the basic chart definition. The Wizard is straightforward and quick; it also uses sample data to display previews, so you don't need actual data to define the way your chart looks. You don't even have to run your project to see what things will look like at runtime: All changes are dynamic, and Apply buttons are used liberally throughout the property sheets to let you update the chart without exiting the dialog you're in.

In addition to the Wizard, the right-click menu lets you access four other formatting items: Edit, Edit Chart, Data, and Properties. When you select Edit, your chart switches into Edit mode, a state that lets you directly select and format individual chart elements such as specific data points, axes, and labels. Double-clicking on an element brings up appropriate property sheets.

If you want to access properties without selecting individual elements, you can select Properties from the context menu and then choose the category to edit. First Impression properties are grouped under General, Plot, Series, Axis, Legend, Title, and Footnote headings. During testing, we found Edit mode to be the most productive way to edit properties, since we could simply double-click on any element we wanted to change.

Most of the chart's look and feel is accessible through the Plot property category (the Plot is the area of the chart where data is plotted, excluding labels, legends, and other elements). In the Plot property sheet, you can change the type of chart, modify how the backdrop and walls of a 3-D chart appear, and even apply 3-D lighting and angling.

One of First Impression's biggest strengths is the control it gives you over 3-D charts. You can define whether the 3-D chart is drawn as orthogonal, oblique, or with perspective, giving you great scope to fine-tune for realism and



FIRST IMPRESSION

clarity. You can completely adjust the rotation and elevation of a 3-D chart and set the viewing distance. The 3-D Lighting page lets you define directed light from nine different positions and ambient light sources. Manipulating the rotation and lighting properties through code can also produce interesting animation effects.

Each First Impression chart object has an associated Data Grid, a special spreadsheet that contains the plotted data. Selecting Edit Chart Data brings up a refreshingly simple interface to the data grid. Here, you simply type in values, including row and column labels that will serve as labels for data categories and series. You also specify how many rows, columns, row labels, and column labels you need. To change data at runtime, you set the current row and column properties for the data grid object and call its SetData method. First Impression is also designed to work with Visual Components' Formula One spreadsheet control and can link directly to a spreadsheet to reflect any cell changes automatically.

THE WORKBOOK DESIGNER lets you customize your spreadsheet using an interface similar to the familiar Microsoft Excel.

By default, First Impression gives the end user complete formatting control over the chart at runtime via context menus. But you can override the normal edit dialogs with your own by inter-

cepting mouse events. An ApplyChanges event lets you execute your own code when a user clicks Apply or OK after making changes.

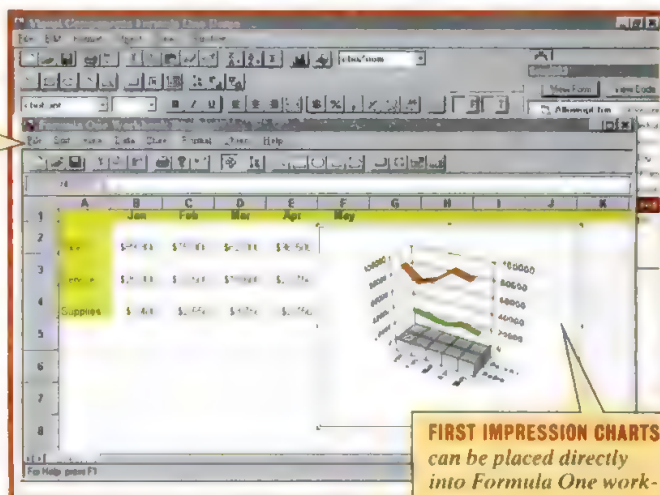
First Impression makes an excellent impression. You also get a generous selection of sample projects that demonstrate how to make the most of the product. It provides superior formatting control, no matter what contortions we performed on our test charts, and its blend of flexibility and ease of use makes it valuable for all levels of developers. **First Impression 2.0.** List price: \$249. Visual Components Inc., Lenexa, KS; 800-884-8665; <http://www.visualcomp.com>. Circle 466 on reader service card.

Visual Components Inc.

Formula One 3.0

If you've ever tried to add simple spreadsheet functionality to a Visual Basic application using Visual Basic's own grid control, you've learned to appreciate the intricacies of mainstream spreadsheet programs like Microsoft Excel. Formula One, from Visual Components, lets you sidestep all that work, giving you an easy way to put sophisticated Excel-compatible workbooks into your application. Priced at \$249, Formula One is a well-designed control that delivers good performance and a comprehensive set of properties, methods, and events.

Like First Impression, the company's charting component, Formula One comes as a 16-bit and a 32-bit OCX; the latest version does not include a VBX control. You simply drop the control onto a form and size it to create a spreadsheet that closely resembles an Excel spreadsheet. You don't need to set any properties to make the spreadsheet functional; however, you will probably want to add menu items and toolbars to execute the methods for operations like copy, paste, and sort. Although the Formula One control does not come with a standard toolbar for runtime use, its straightforward method syn-



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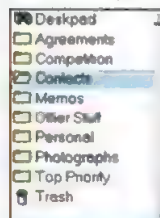
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Each Formula One workbook can contain up to 256 separate sheets. Formula One reads and writes Excel workbooks, including the newer 5.0 and 7.0 formats. It also reads delimited text files and reads and writes its own native files to support functions not available in Excel. There are some limitations to the Excel compatibility. Formula One doesn't support Excel files containing charts, password-protected files, and some Excel functions. Files with unsupported functions or charts can be read, however; Formula One simply ignores the unsupported elements.

Formula One spreadsheets support the company's First Impression chart control. You can highlight the data you want to chart and set the Mode property to ModeChart to place a chart on the sheet. If the First Impression control is installed on your system, you will be able to draw it on the sheet. When you place the chart, a link between the two controls is established, so the chart will automatically update in tandem with any changes to the spreadsheet data.

Integrating spreadsheets and charts on the same sheet worked well during our testing, but we were unable to place a chart on a separate sheet in the same workbook using the underlying data. Using the included MDI sample program (a very useful VB project illustrating many of the control's features), we experimented with placing First Impression charts on separate sheets and viewing the data. We found that this eventually resulted in a GPF. We didn't experience problems placing charts on the same sheet, however, and the integration was very smooth.

Formula One's property page is surprisingly petite. Three tabs labeled General, Allow, and Show provide access to some of the more basic settings for the spreadsheet control. The General page controls items such as the spreadsheet name, AutoRecalc, and ViewScale. The ViewScale property lets you zoom in or out, a feature that is also very useful at runtime to let your users fit more or less information on the screen. The Allow tab controls some basic keyboard, mouse, and editing behaviors, and the Show tab lets you define the size of the spreadsheet and other visual characteristics.

The most powerful design-time customization tool is the Workbook Designer, a special window accessible from the context menu in design mode. The Workbook Designer closely resembles the workbook at runtime, but adds a formatting toolbar. You can use it to format cells, open Excel files, place charts, draw shapes, and perform many other formatting operations.

Of course, no spreadsheet is complete without all those hard-to-remember functions. Formula One comes with 130 functions, including financial, trigonometric, date/time, and string conversion calls. You can also de-

fine data validation rules for ranges of cells to enforce proper data entry. And you can bind Formula One workbooks to ODBC data sources to provide database browsing; there is currently no direct support for the Visual Basic data control.

Formula One's Excel-file compatibility is up to date with its Version 7.0 support. It performs well, and its clear property and method names don't bog you down. Overall, this is the most useful spreadsheet control we've seen, a great way to give your application industry-standard spreadsheet support.

Formula One 3.0. List price: \$249. Visual Components Inc., Lenexa, KS; 800-884-8665; <http://www.visualcomp.com>. Circle 467 on reader service card.

Pinnacle Publishing Inc.

Graphics Server 4.0

Graphics Server 4.0, from Pinnacle Publishing, is the extended version of the Pinnacle charting control included with Visual Basic 4.0. This version includes 16-bit and 32-bit OCX controls. 16-bit and 32-bit DLLs, and a VBX control. Priced at \$299, Graphics Server 4.0 is much richer and more flexible than the standard Chart32.ocx control.

We tested the 32-bit OCX control in the

glass-like shape around them.

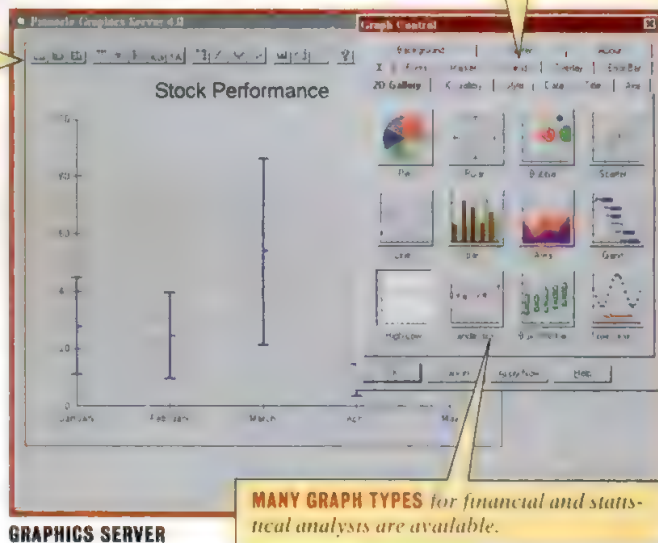
Graphics Server does not offer quite as many variant styles to each type of graph as some other charting controls, and it separates different flavors as entirely different graph types. For example, line, area, 3-D area, and tape graphs are considered different types, although they are essentially different styles of a line graph. The control's property page has separate tabs for 2D Gallery, 3D Gallery, and Style to define a graph's look. We found the distinction between the types and styles a little muddled and in some cases redundant. For example, when we set the graph to the line type and checked the Symbols box in the Style tab, we wound up with essentially the same thing as the base Scatter type. For some graph types there aren't even any options on the Style tab.

Otherwise, Graphics Server gives you lots of control over your chart's properties with its 15 separate tabs in the property page. We especially liked the Trend tab, which gives you a quick way to add statistical markers to your graphs. On certain graphs, you can enable horizontal lines indicating minimum, maxi-

PROPERTIES LIKE TRENDS and standard deviation are easy to apply from the Trends tab in the property sheet.

A RUNTIME TOOLBAR is available for placement in your graphs to provide end users with extra flexibility.

Graphics Server package under VB 4.0 and found it quick and easy to use for basic graphs. Although it doesn't include quite as many chart types as First Impression, it supports all the more common styles you're likely to need. Graphics Server also includes several interesting types that apply to statistical and financial applications: Gantt, hi-lo, candlestick, and box-whisker. While the Gantt and hi-lo types are easily recognizable as presentation tools (for project management and stock analysis applications, respectively), the candlestick and box-whisker types are more unusual. The candlestick chart is actually just a variant of the hi-lo that emphasizes the closing direction by filling the point with color if a stock is up and outlining it if the stock closes down. The box-whisker graph shows the distribution of sets of values around their median and six other percentiles by plotting the points vertically with an hour-



mum, mean, and standard deviation, and you can also enable curve-fitting. Although this feature is very useful for analysis, it unfortunately does not work with the 3-D versions of line, bar, and scatter graphs.

Graphics Server offers a unique way to adjust your 3-D view. The 3-D tab gives you a preview of your 3-D graph, bounded by three scroll bars that let you smoothly adjust the rotation, elevation, and perceived distance from the graph. We found the scroll bars a nice, straightforward way to adjust our 3-D graphs, but the depth control didn't act as expected. Instead of making the graph smaller as we adjusted it to-

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ward the Out setting, the control seemed to elongate the depth of the chart, an adjustment available through a separate Depth scroll bar on the 3-D tab.

One of Graphics Server's nicest features is its runtime behavior. You can display the control's standard toolbar at the top of your graph to let the end user modify its look. Buttons on the toolbar represent the different tabs in the property sheet. If you want the user to have access to only some of the control's properties, you can selectively disable individual buttons. The toolbar has a fixed width and may not be floated to fit into smaller graphs, however.

If you feel you can improve on the control's standard property tabs, you can build your own. You can intercept the ToolHit event when the user clicks on a toolbar button and use your own dialogs for end-user property changes.

The Graphics Server OCX control is only part of the product. The package also comes with robust DLLs and even a C++ custom graph class. The documentation is excellent, and example programs are included for many different development tools, including Borland Delphi, CA-Visual Objects, Gupta SQL-Windows, Microsoft Visual FoxPro, and PowerBuilder. From a coder's perspective, Graphics Server is a fine product, although it could use improvements to the organization of its interactive design features.

Graphics Server 4.0. List price: \$299. Pinnacle Publishing Inc., Kent, WA; 800-788-1900; <http://www.pinpub.com>. Circle 468 on reader service card.

Apex Software Corporation

VBA Companion 1.0

OLE Automation is the bedrock of Microsoft's component strategy. It lets you tap the functionality of exposed objects belonging to other applications so you can make your own application all the more powerful. In fact, the OCX controls reviewed here are a special type of OLE Automation object.

VBA Companion, \$79.95 from Apex Software Corp., is an OLE object browser that facilitates the use of exposed OLE objects by helping you make sense of what is too often a murky brew of objects, properties, and methods. VBA Companion aims to be the "File Manager of OLE objects" and certainly lives up to the claim. It is a standalone application that retrieves all your system's exposed OLE objects and presents them to you in a clear

tree format that can be traversed, expanded, and collapsed.

The program is not an OLE control like the other products reviewed here, but since it helps you work with both OLE controls and other exposed OLE Automation objects, we feel that it deserves to be included.

VBA Companion includes both 16-bit and 32-bit versions, so you can use it on Windows 3.1 as well as Windows 95 and Windows NT 3.5x. We tested the 32-bit version of VBA Companion on Windows 95.

When you start VBA Companion for the first time, it reads the Registry to retrieve all your system's OLE objects.

The VBA Companion Workspace consists of the Object Tree Pane, Information Pane, and Attribute Pane, which vary in number according to the object selected. The Object Tree Pane is the master listing of all OLE objects, categorized at the highest level as OLE controls, object applications, and type libraries. As you click on any primary object, the tree expands to show its composite elements.

THE INSTALLED OLE OBJECT DEFINITIONS
from your Windows 95 Registry are easily read. Double-clicking on an object reveals its individual elements, with icons representing their types.

Expanding the tree of OLE objects reveals their total organization. It can also give you a new perspective on your OLE control's makeup. Elements include Createable Objects, which you can create from your code, and their individual Programmable Objects, which you can manipulate but not create. For example, when browsing the Apex Data Bound Grid control, we found the DB-Grid Createable Object and its Programmable Objects such as Columns and RowBuffers.

When you double-click on an object in the Object Tree, the Attributes Pane presents scrollable grids that display all the object's attributes. Programmable Objects produce two grids that list their properties and methods; Createable Objects adds a third grid that displays their events. The grid lists each property with its data type and description, if one is

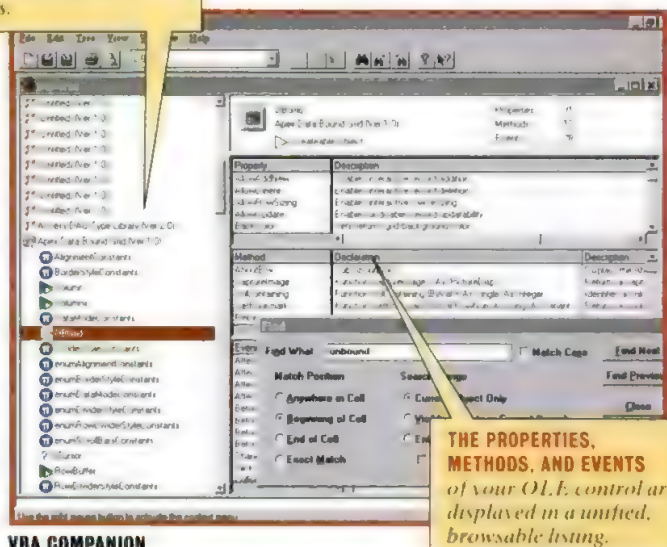
included within the object's Registry entry. Method and Event entries also show declaration templates, which you can paste into your applications. If the OLE object author associated a help file for the object or one of its attributes, double-clicking on it will bring up the appropriate help page.

In addition to general browsing features, VBA Companion also offers the unique ability to search the tree of OLE objects for specific text. You can search within a single object, a branch of objects, or the entire OLE tree. You can also hide individual objects or categories—16-bit objects, for example—to make the tree easier to browse.

VBA Companion is also designed for users who want to exploit VBA, Microsoft's standard automation and application-integration language for its business applications. By the time you read this, all the Microsoft Office applications may include VBA; however, when VBA Companion was released, Microsoft Access and Word were not yet VBA-compliant. VBA Companion includes a type library for Microsoft Word 6.0 and a browsing emulation for Microsoft Access 2.0 Data-Access Objects, so you can get at the details of these objects as well.

One of the program's most useful features is its documentation facility. You can print out a report for any OLE object that details its properties methods and events.

VBA Companion is a prime example of a utility program that eases your development



efforts by simply adding clarity to the situation. Whether you intend to do extensive VBA work or simply want a unified way to view the details of your OLE controls, VBA Companion will be a loyal ally. □

VBA Companion 1.0. List price: \$79.95. Apex Software Corp., Pittsburgh, PA; 800-858-2739; <http://www.apexsc.com>. Circle 469 on reader service card.

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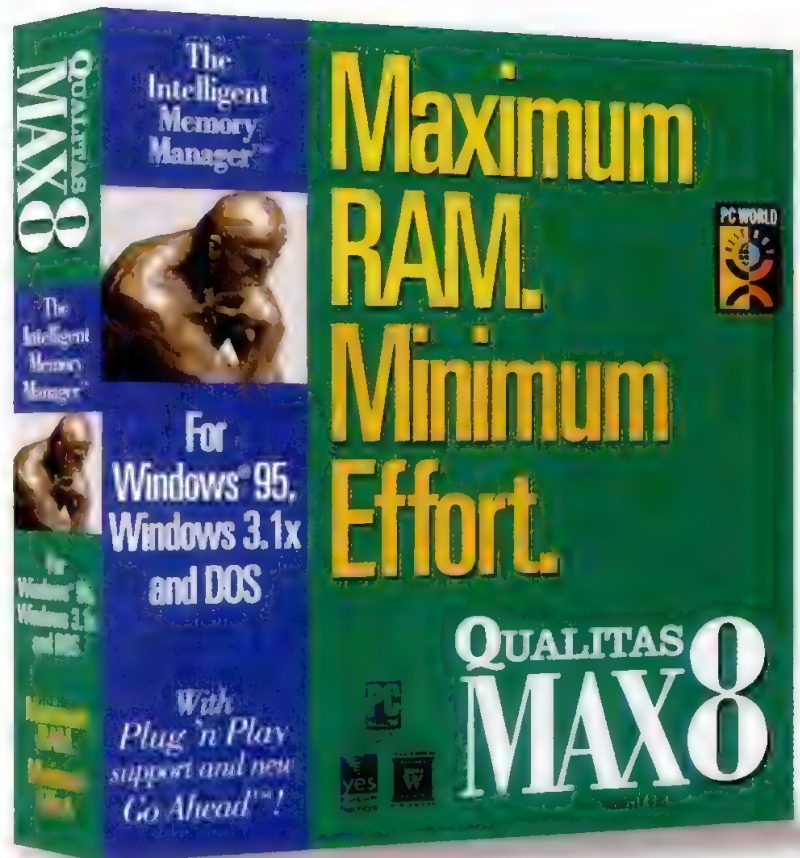
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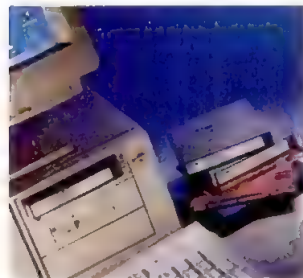
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PC Tech/Tutor

By Jeff Prosize

A Side of the Shell You've Never Seen

Windows 95 not only supports OLE but also *uses* it.

A little more than two years ago, I was sitting in an auditorium in Redmond, Washington, listening to a series of presentations on Microsoft Windows 95, then called Chicago, when the speaker mentioned that "the Windows 95 user interface will make extensive use of OLE." Hmm, I thought, that's interesting. OLE was an add-on in Windows 3.1. It was already clear that support for OLE would be built into Windows 95, but having the operating system *support* OLE and having it *use* OLE are two different things. If what the speaker had just said was true, Windows 95 might be a portent of things to come. It had been rumored that OLE would eventually become the core of Windows itself, but it was unclear at that time what it meant to build a user interface around OLE, much less an entire operating system.

Now it is very clear what the speaker meant that day. Whereas in the past Windows exposed its functionality primarily through application programming interface (API) functions, the Windows 95 shell—the program that forms the operating system's user interface—exposes many of its features through OLE interfaces. The shell also uses OLE interfaces to support plug-in user-interface extensions such as DLLs that get called into action when files are dropped on an icon. Looking at the shell reveals a lot about how future versions of Windows might be architected. And it says a lot about Microsoft's plans for OLE, which, despite many developers' wishes to the contrary, is only going to increase, not diminish, in importance.

You've seen what the shell looks like on the outside. Now let's look on the inside and see what makes it tick—specifically, what part OLE plays in the shell's day-to-day operation. It will probably be a side of the shell you've never seen.

FOLDERS AND NAMESPACES

The logical place to begin a discussion of shell internals is the shell's namespace. A *namespace* is a collection of symbols representing some set of objects, such as the files

on a hard disk or records in a database. A namespace for a file system might include symbols for drives, directories, and files. A namespace for a database, on the other hand, might include symbols for records and keys. A *namespace browser* is a program that lets you browse a namespace by navigating among the symbols. The Windows 95 Explorer is one example of a namespace

Neighborhood, and other objects, as well as any files, folders, or shortcuts you've placed there yourself. A *folder* is simply a collection of items in the shell's namespace. Directories on your hard disk are folders in that namespace, but the terms *folder* and *directory* are not necessarily synonymous. The shell also uses folders to group printers and other items that have no direct analogue in the file system and therefore cannot be stored in file-system directories.

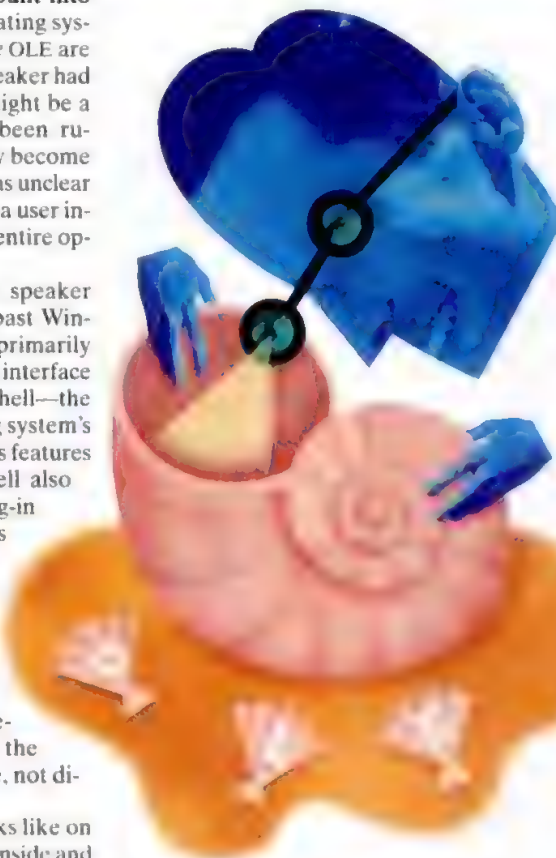
Folders are accorded special rank in the shell's namespace, because they are objects that implement the OLE IShellFolder interface. In the world of OLE and the Component Object Model (COM) that forms the basis for OLE, an interface is a group of functions, or *methods*, that share a common purpose. Given an interface's address in memory, an application can call methods that are members of that interface to communicate with the object that implements the interface. It's sort of like calling a subroutine in program A from program B and having it perform some useful operation on program A. Now think of program A as an object (such as a shell folder) and program B as a *user* of that object and you'll have a pretty good understanding of what OLE is all about.

The IShellFolder interface contains about a dozen methods that an application can use to acquire information about a folder. One is IShellFolder::EnumObjects, which enumerates the folder's items. Another is IShellFolder::BindToObject, which returns an IShellFolder pointer to a subfolder. When you browse My Computer and double-click a folder representing a directory on your hard disk, the shell does not call file-system functions to find out what's stored in that directory, at least not directly; instead, it calls the current folder's BindToObject method to "bind to" (that is, get an IShellFolder pointer for) the subfolder you just clicked. Then it calls the subfolder's EnumObject method to create an "enumeration object" that supports the IEnumIDList interface and uses members of that interface to list the subfolder's contents.

Closely related to IShellFolder is the shell's IShellLink interface, which represents objects that contain references to other objects in the shell's namespace. Ever

browser. With it, you move around in the shell's namespace and view the various resources the shell makes available to you.

The shell's namespace contains a hierarchical grouping of symbols for files, directories, drives, printers, network resources, and other items accessible from your PC. At the top of the hierarchy is the Desktop folder, which contains My Computer, Network



wonder what happens behind the scenes when you create a shortcut to a document or application and place it on the desktop for quick access? It's pretty simple, really. The shell creates a shell-link object and sets a few parameters, such as the name of and path to the file that the shortcut represents, using `IShellLink` functions such as `SetPath`. Then it calls `IPersistFile::Save` to create the shortcut. The result is a .lnk file that shows up on the screen as an icon with a small arrow in the corner. And because the `IShellLink` interface is documented and open to everyone, applications can mimic the shell's actions if they, too, would like to create shortcuts.

SHELL EXTENSIONS

Another component of the shell that uses OLE is the part of it that supports shell extensions. A shell extension is a DLL (in OLE parlance, an *in-process server*) that extends the shell by adding items to context menus, adding pages to property sheets, turning icons into intelligent drop targets, and so on. For examples of shell extensions, see our Utilities columns of December 19, 1995, and January 23, 1996.

The shell supports seven different types of shell extensions, as Figure 1 shows. Each type of shell extension is distinguished by the OLE interfaces it supports and the manner in which it implements those interfaces. A context-menu extension, for example, implements the `IShellExtInit` and `IContextMenu` interfaces. When the user right-clicks on an object in the shell's namespace, the shell checks the Registry to see if there's a context-menu extension registered for objects of that type. If there is, the shell loads the DLL that contains the context-menu extension, calls a function in the DLL to create a shell exten-

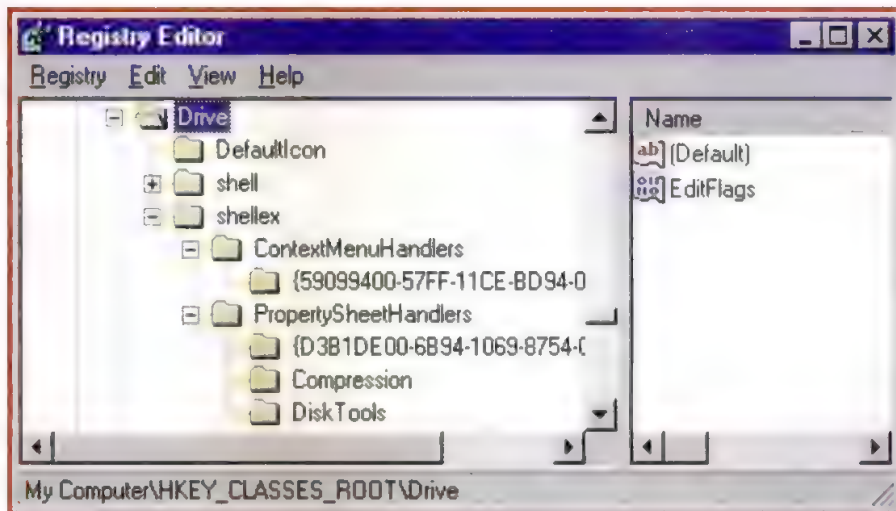


FIGURE 2: The Registry Editor window showing shell extensions registered for drive objects.

one of those items, the shell calls the shell extension's `IContextMenu::InvokeCommand` method to execute the command.

The shell communicates with a drop handler shell extension through two entirely different interfaces: `IPersistFile` and `IDropTarget`. My ZipDrop extension featured in the Utilities column of January 23, 1996, is a drop handler that compresses files and adds them to a .ZIP file when those files' icons are dragged and dropped onto a .ZIP file icon.

When a file is dragged over an object for which a drop handler is registered, the shell loads the drop handler's DLL, creates a drop-handler shell extension, and passes the name of the file that will be the drop target to the shell extension through `IPersistFile::Load`. It then calls the shell extension's `IDropTarget::DragEnter` method to notify it that a drop may occur, `IDropTarget::DragOver` to let it know when the mouse pointer moves,

What shell extensions amount to are powerful devices for third parties to enhance the shell. Windows 95 even uses shell extensions itself; some of the features that you probably think are built into the shell are actually implemented as shell extensions. The Tools page that appears in the property sheets for drive objects, for example, is a shell extension. So is the Compression page that appears if a drive is compressed. When you create a document scrap by highlighting a selection of text or other data and dragging it to the desktop, the shell stores the scrap's data in a file with the extension .shs. And guess what? When that scrap is pasted into another document, a data-handler shell extension that Windows provides for .shs files permits the recipient to extract the scrap's data.

You can see for yourself how and where Windows 95 uses shell extensions by starting `RegEdit` and using the `Edit | Find` command to search on the keyword "shellex." This is the registration key used for all shell extensions, and if you expand the `shellex` subkey for a given object type, you'll see a list of the shell extensions that are registered for it. `DataHandler` identifies data handlers, `PropertySheetHandlers` identifies property-sheet handlers, and so on. Figure 2 shows my system's `HKEY_CLASSES_ROOT\Drive\shellex` branch of the Registry, where shell extensions for drive objects are registered. You can see that drives are served by one context-menu shell extension and three property-sheet shell extensions. The shell extensions labeled `Compression` and `Disk Tools` add pages with the same name to the property sheets that the shell displays for drive objects.

FILE VIEWERS

When you right-click a .bmp file in the shell's namespace, the ensuing context menu includes a Quick View command that, when

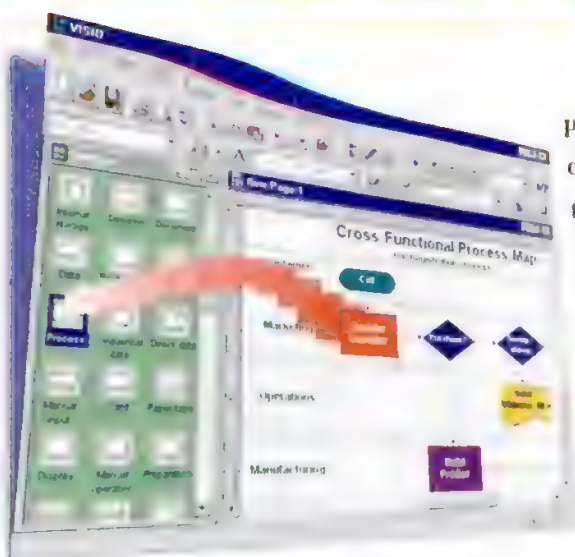
SHELL EXTENSION TYPES

Extension type	OLE interfaces	Description
Context-menu handler	<code>IShellExtInit</code> , <code>IContextMenu</code>	Adds commands to context menus.
Drag-drop handler	<code>IShellExtInit</code> , <code>IContextMenu</code>	Adds commands to right-drag context menus.
Property-sheet handler	<code>IShellExtInit</code> , <code>IShellPropSheetExt</code>	Adds pages to property sheets.
Icon handler	<code>IPersistFile</code> , <code>IExtractIcon</code>	Provides instance-specific icons for files and other objects displayed by the shell.
Copy-hook handler	<code>ICopyHook</code>	Exercises veto power over moves, copies, and other actions performed on folders.
Data handler	<code>IPersistFile</code> , <code>IDataObject</code>	Exposes an object's data to drop-target objects.
Drop handler	<code>IPersistFile</code> , <code>IDropTarget</code>	Converts icons into drop targets.

FIGURE 1: The Windows 95 shell supports seven types of shell extensions. It communicates with shell extension objects using the OLE interfaces listed here.

sion object, and calls that object's `IShellExtInit::Initialize` method with the name of the file, folder, or other object that was clicked. Then it calls `IContextMenu::QueryContextMenu` with information that allows the shell extension to add items to the context menu. If the user subsequently selects

and `IDropTarget::Drop` if a drop occurs. The shell extension responds to these calls by telling the shell what will happen if a drop occurs (so the shell can provide visual feedback to the user) and ultimately by accepting the dropped data if the `IDropTarget::Drop` notification is sent.



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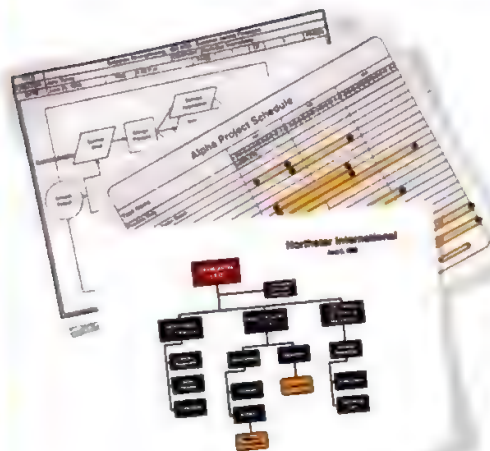
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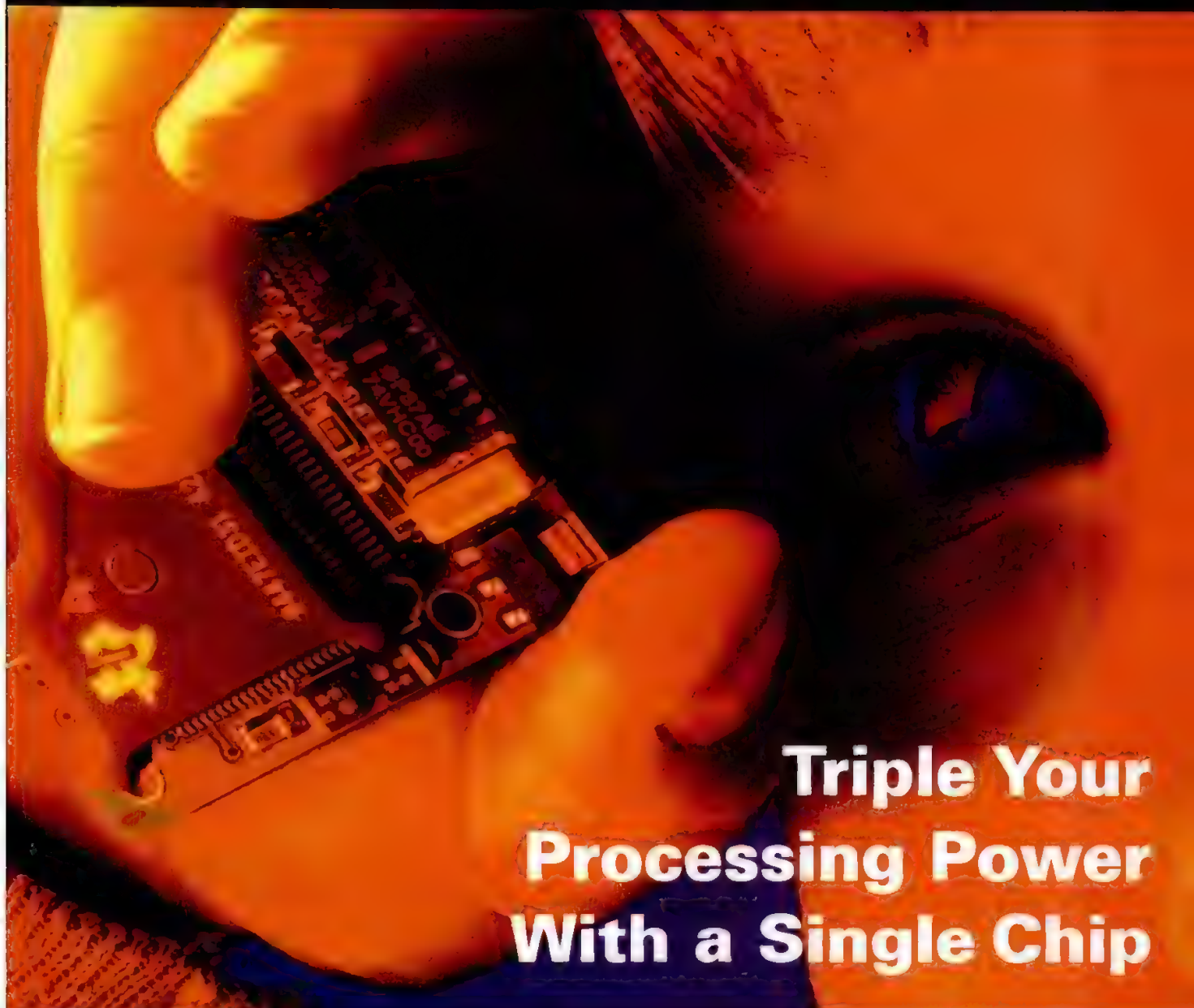
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invoked, displays the .bmp file's image in a resizable window. (If you don't see Quick View in the context menu, it wasn't installed when you set up Windows 95. To install Quick View, open the Control Panel's Add/Remove Programs applet, click the Windows Setup tab, highlight Accessories, click Details, and make sure Quick View is checked in the list box. Then click OK.) It will probably come as no surprise by now to learn that file viewers are OLE objects that the shell communicates with using IPersist-File and IFileViewer interfaces. Here's what happens behind the scenes to make them work.

When Quick View is selected from the context menu, the shell starts an instance of an application named Quikview.exe. Quickview, in turn, checks the Registry to see if a viewer is registered for files of that type. If the answer is yes, Quickview loads the file viewer DLL, creates a file viewer object, passes it the name of the file to be viewed through IPersistFile::Load, and then calls IFileViewer::ShowInitialize followed by IFileViewer::Show commanding the file viewer to display the file's contents. Once again, OLE interfaces play a key role by serving as a communications medium between the shell and an object that does the shell's bidding.

You can obtain a concise list of file types for which viewers are registered by using RegEdit to view the HKEY_CLASSES_ROOT\QuickView branch of the Registry. On my PC, this includes about 30 different file types ranging from files with the extension .asc to files with the extension .xls.

Future versions of Windows will provide documented hooks enabling applications to create namespaces of their own.

THE BIG PICTURE

These are just a few examples of the ways in which OLE has been woven into the fabric of Windows 95. So what does it all mean?

If you're an application developer, it means you'd better get used to OLE, because it's going to be around for a while. Some of the most enticing new features of

Windows 95 are accessible only through OLE interfaces. In the future, it's conceivable that more features will be exposed through OLE interfaces and fewer through standard API functions. There are still some developers who think, "If I'm not writing an application that supports compound documents, I have no use for OLE." Wrong. OLE already concerns much more than just compound documents, and its scope is expanding every day.

If you're a user of applications rather than a developer, it means you're going to see richer applications than ever before. Already Windows 95 applications enjoy unprecedented power to integrate themselves with the operating system shell by accessing its namespace, thereby adding on to the shell itself. Future versions of Windows will make even higher levels of integration possible and provide documented hooks enabling applications to create namespaces of their own. Imagine Windows applications that make databases, the Internet, and on-line services such as CompuServe look like just another desktop. Not only is it possible, but it is going to happen. And soon.

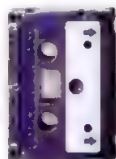
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Jeff Prosise is a contributing editor of PC Magazine.

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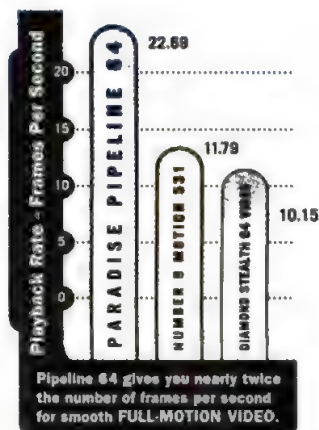
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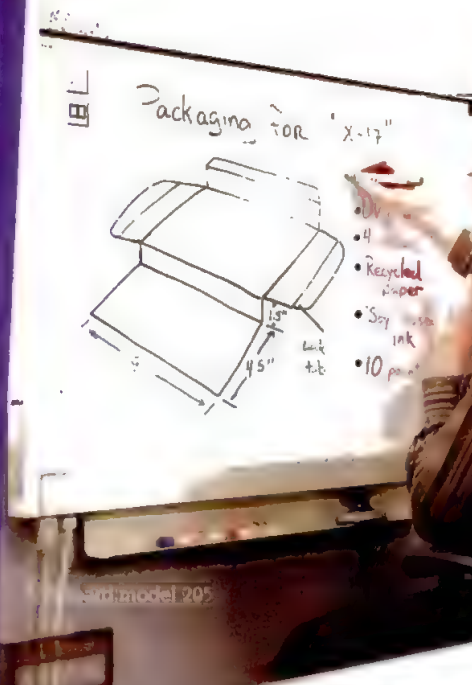


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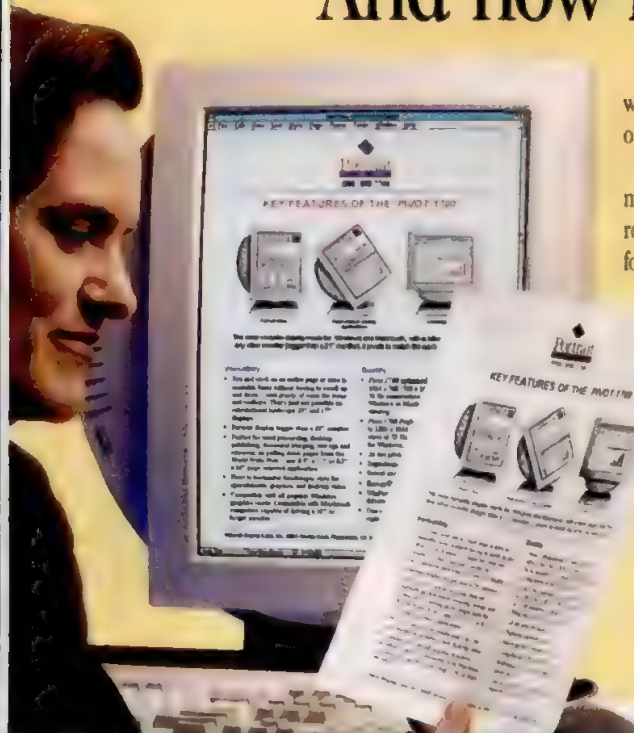
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PC Tech/Inside Windows 95

By Richard Hale Shaw

Custom Interfaces, Customizable Objects

OLE Automation lets you create programmable objects.

Our tour of Object Linking and Embedding (OLE) now veers in a new direction, away from traditional OLE where end users create compound documents using container applications, inserting data created by an object server, and away from predefined application scenarios like visual or open editing. Instead, we'll look at a part of OLE where application scenarios are not predefined, where application activities are not necessarily driven by end-user actions, and indeed where user interfaces aren't required at all. The technology we'll explore is OLE Automation; with this technology, OLE's lack of interface implementations gives developers the opportunity to create their own custom interfaces that follow their own scenarios.

WHAT IS AUTOMATION?

OLE Automation is an inter-process communications (IPC) mechanism for Windows that lets one application or component drive, or *automate*, another. OLE Automation differs from the high-performance IPCs introduced with Win32, because it provides only the basic mechanism for letting disparate program modules communicate and connect; it's up to the developer to supply the names of the connection interfaces and to specify how they are to be used. And while the high-performance IPCs are limited specifically to Win32 (and thus to Windows NT, Windows 95, and Win32s), OLE Automation is fully supported on all Windows platforms—including Windows 3.1.

WHY NOT DDE?

Traditionally, Windows IPC problems have been solved by Dynamic Data Exchange (DDE). DDE is a message-based protocol where one application, the DDE client, can request data from another, the DDE server. There are three basic types of DDE transactions or conversations:

- A cold link, where the client requests data from a server.

- A warm link, where the client requests a notification from the server whenever some specified data changes.

- A hot link, where the server sends the client both the notification and the data itself when the specified data changes.

These are all scenarios that you can also implement with OLE Automation, and automation offers some distinct advantages:

- DDE uses Windows messaging to support interprocess communications. Automation,

- While automation between disparate applications takes place indirectly through the Component Object Model's (COM's) proxy-stub pair, a direct connection is possible between an automation client and a DLL-based (in-process) automation server. Automation is generally faster than DDE in any case, and in-proc automation servers will always outperform DDE servers.

DDE has never been well documented, and it has often been inconsistently implemented.

Like many Windows components, DDE was created by the Excel development group and only later moved into Windows. As a result, some versions of Excel—and some non-Microsoft applications as well—didn't behave as expected when accessed via DDE. As *PC Magazine* contributing editor Charles Petzold once summarized, "DDE is the protocol from hell." Because automation is largely a platform where a server developer can create his own interfaces and a client developer can access them, it isn't subject to these kinds of inconsistencies.

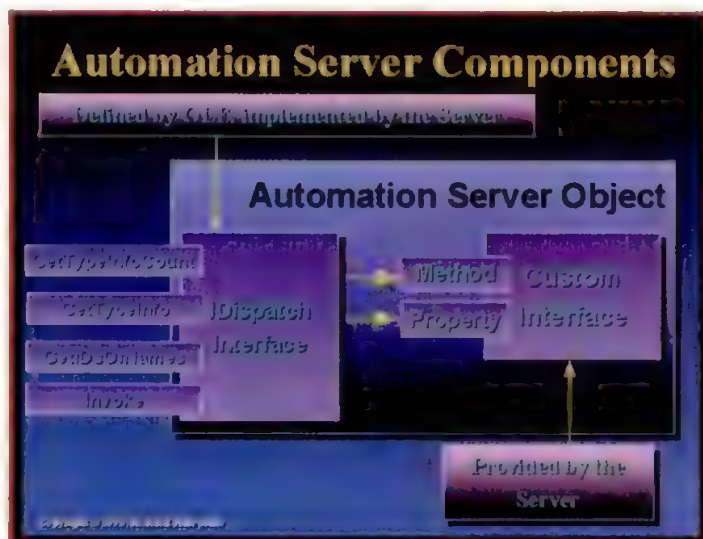


FIGURE 1: OLE's IDispatch interface provides functions to let it serve as a platform for exposing the properties and methods that make up an automation object.

on the other hand, is function-based: It lets a component expose functions for accessing data and functionality in a server.

- DDE's messaging imposes a protocol on developers: The developers of both the DDE client and the DDE server must shape the application to use the DDE protocol correctly. With automation, the developer designs the server to best fit the needs of a client application that will use the services provided. The server developer invents the scenarios that delineate how the server will be used, describing what automation methods and properties should be used, when, and why. Automation server design, therefore, is more flexible than DDE and can be driven by market demands rather than by a predefined protocol.

OLE'S IDISPATCH INTERFACE

Unlike other forms of OLE—traditional object linking and embedding, for example, where a developer must implement predefined interfaces to fit into a set of predefined user-driven scenarios—automation requires the implementation of just a single OLE interface: IDispatch. IDispatch doesn't predefined any scenarios. Instead, it lets a component define a custom interface that another OLE-based component can easily use.

The purpose of IDispatch—and thus automation—is to make it possible for a Windows application to expose functions and data in the form of automation methods and properties, which are combined in logical units known as automation objects. An application or component that exposes such objects is an *automation server*; a component that uses such objects is an *automation client*.

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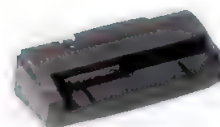


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tion doesn't live outside of COM. (For more information, see "OLE's Component Object Model," *PC Magazine*, November 21, 1995.) And like the other features, it counts on OLE programs to connect and communicate through COM. Thus, an automation client will call an OLE API to get COM to do the following:

- Invoke the appropriate automation server.
- Have that server create an instance of a class factory.
- Have the class factory create an instance of a specific automation object.
- Return a pointer to the IUnknown interface of the newly created object.

Via IUnknown::QueryInterface, the automation client can retrieve pointers to other interfaces supported by the automation object.

But here the parallels with other OLE elements end. An automation client can use IUnknown::QueryInterface to retrieve an automation object's IDispatch interface. Via this interface, the automation client can access an automation object with a custom interface of methods and properties exposed by the server. Consequently, an automation-server developer can design custom interfaces that can be exposed for use by other applications or components.

Unlike other OLE interfaces, IDispatch is largely independent of the rest of OLE; a component that supports IDispatch need not support any other part of OLE (except IUnknown). Additional communications between a container or client and an IDispatch-based server can proceed via IDispatch. Thus, once an automation client retrieves the IDispatch of an automation object, the two components can communicate directly: OLE simply drops out of the way. Because of this independence, automation can be used in applications that are neither object containers nor object servers; of course, it can be used to enhance containers and servers as well.

You can write a standalone program that doubles as an automation server, exposing data and functionality as properties and methods that other applications can use. Microsoft Excel is an example of a standalone application that's also a server. But an automation server can also reside in a DLL. And while EXE-based automation servers require the proxy-stub pair that traditional OLE uses for out-of-process communications between components in disparate address spaces, there's a direct connection between an IDispatch pointer in an automation client and an in-proc (DLL-based) automation server's IDispatch interface. So if you prize performance,

it makes the most sense to put servers that don't need to run as standalones in a DLL.

USING IDISPATCH

The OLE IDispatch interface lets an automation client access the custom interface offered by an automation server (Figure 1). The client can determine an automation object's methods and properties, and the data or return types and IDs of each (IDispatch requires that each method and property have a specific ID), and it can invoke these methods and properties. This is accomplished through the four functions that comprise the interface: GetTypeInfoCount supplies the number of methods and properties supported by the server, along with the number of method parameters; GetTypeInfo yields the name and type of each property, method, or method parameter;

ods in that server's automation objects during development; indeed, the server doesn't even have to be installed on the developer's system. And dynamic use of IDispatch also lets a client make runtime decisions about what properties and methods to use, though this isn't necessarily typical. Visual Basic and Excel both use IDispatch dynamically, by default.

IDispatch can also be used statically, that is, with a *type library* (a file that describes the custom properties and methods exposed by an automation object). A type library may be furnished by the vendor of an automation server. It provides method and property names, types, and IDs so that the developer of an automation client can build this information into the design of the client. With the type information already available, an automation client can simply invoke methods and properties in an automation

object without having to query the server about this information. The ability to read a type library and use IDispatch statically was added to VB only with the release of Version 4.0; both Excel and Visual C++ have supported this approach all along.

The major advantage to using IDispatch statically is performance. Without a type library, an automation client must query the server to verify the names and types of properties and methods in an automation object and to retrieve their IDs. But with information from a type library wired in, the client can simply access properties and invoke methods directly: There's no need to query the server in advance. So while static use of IDispatch requires more work during

development, an automation client using a type library has to invoke an automation server object only once at runtime to access a method or property. Using IDispatch dynamically, on the other hand, forces the client to invoke the object at least twice: once to verify the method or property name and retrieve the ID and again to actually invoke the property or method.

The variation in performance isn't as pronounced with an in-proc (DLL-based) server, but with an out-of-process (EXE-based) server, that extra traversal of a process boundary can be expensive, to say the least. Thus, it's considered poor form for an automation-server vendor not to provide a type library whenever a new version of a server is released.

AUTOMATION ACROSS THE NETWORK?

There is one area where DDE may still maintain a leg up on OLE Automation: networking. While network DDE has been in place for some time (at least since the advent of Windows for Workgroups), there is no official,

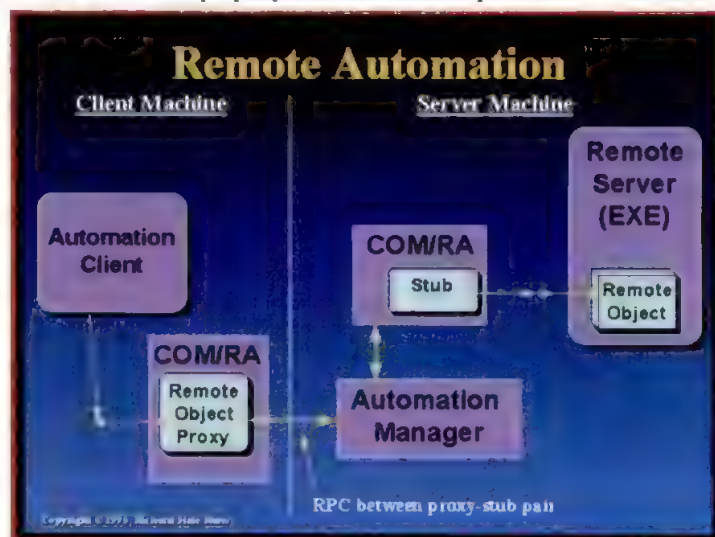


FIGURE 2: With Remote Automation, the traditional proxy-stub pair is replaced with components that let a local automation client connect to a remote server.

GetIDsOfNames returns an ID for a given method or property name; and Invoke calls a given method or property via its ID.

The first three functions allow IDispatch to be used dynamically. Suppose an automation client knows the names and data types of properties, methods, and method parameters, but doesn't know the property or method IDs. A typical Visual Basic (VB) program, for example, might invoke an automation object method. The program doesn't know the method ID, however, just its name. So VB calls IDispatch::GetIDsOfNames in the server to retrieve the ID in order to invoke the method. Indeed, VB doesn't even know if the method name is correct—it assumes that the programmer provided the correct method name. But, via IDispatch, VB can dynamically verify the existence of a specific property, method, or method parameter.

By using IDispatch dynamically, a developer can defer having to invoke a server to verify the identity and types of properties and meth-

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Inside Windows 95

sanctioned mechanism for networked automation at the moment. Officially, automation across the network is supposed to appear as a component of Distributed OLE, part of which is set to debut with the next release of Windows NT (unofficially dubbed NT 4.0) in April. Via Distributed OLE, networked automation would use the same proxy-stub pair that connects clients and EXE-based servers running in different address spaces. But in this case, it could connect clients and servers running on different machines as well.

Based on the information available at the end of 1995, though, networked automation via Distributed OLE will apply to EXE-based servers only. The reason? Without an .EXE to load it, an in-proc or DLL-based automation server cannot be loaded to support an automation client—on a networked system or on a single machine. It is unclear at this time whether Microsoft's OLE group has yet to figure out an acceptable (that is, safe and robust) solution to the problem of in-proc servers running remotely, or indeed whether they have any intention of doing so. So for the time being, plans for networked automation components do not include DLL-based automation servers.

For the short term, though, a technology is at hand that lets you implement OLE Automation solutions across a network. Under pressure from some of its large corporate customers, Microsoft's Visual Basic team has developed a technology called Remote Automation that lets any out-of-process automation server execute on a remote system. And Remote Automation will also work with an in-proc automation server, provided the latter is invoked by an out-of-process server on the same system. The out-of-process server uses Remote Automation to connect to the client and provides a layer of middleware between the client and the remote in-proc server. Remote Automation will work with any automation client-server pair; they don't have to be written in Visual Basic. And Remote Automation is supported on such major network transports as the Internet, IPX, Named Pipes, NetBEUI, and TCP/IP, as long as the server resides on a system running Windows NT or Windows 95 (the client can run on a Windows NT, Windows 95, or even a Windows 3.1 system).

Because Remote Automation uses the same binary interfaces as local automation, it will work with existing automation components—right out of the box. Thus an automation client-server pair could be designed, developed, tested, and debugged on a single machine and then deployed on a remote system. To implement a connection to an automation server on a remote system, Remote Automation replaces the normal proxy-stub pair with new modules that use standard Remote Procedure Calls (RPCs) to communicate over a network. The replacement proxy runs on the client system and uses RPCs to pass client

requests and data to a component known as the Automation Manager, which runs on the remote system along with the server and the replacement stub (Figure 2). The Automation Manager uses the replacement stub to translate requests from the replacement proxy into invocations of the remote server. The client works with the replacement proxy the same way it did with the original proxy, and the Automation Manager is invisible to the remote server because of the replacement stub in between. The Automation Manager uses the replacement proxy and stub to marshal parameters between the components, just as the traditional proxy-stub pair would. Neither the client nor the server know they are being used remotely. And the Automation Manager creates a separate thread to work with each client, so it can service multiple client requests against the server efficiently.

Unfortunately, Remote Automation is largely considered a "hack" by the OLE group at Microsoft, because it's only a first step and doesn't offer the security and robustness that Distributed OLE will provide. But corporate developers often find such solutions productive and profitable—particularly if they understand from the outset that the solution is a short-term one. And Remote Automation is a strictly short-term solution.

In any case, using Remote Automation now—and Distributed OLE when available—lets developers solve a number of software problems in ways that are feasible only with multiple systems. For example, on a networked system, hardware-intensive calculations and time-consuming database searches can be off-loaded to a secondary system to avoid tying up the user's primary system. Or a developer could use a Remote Automation server to provide a cleaner, more elegant interface to a complex server mechanism (like an SQL engine) and incorporate business rules in the remote server's interface implementation.

From the moment automation was first introduced, it has been perhaps the most misunderstood and underrated part of OLE. Indeed, the worst perpetrators of automation disinformation have been those at Microsoft who claim that the sole purpose of OLE Automation is to support application macro languages. It is true that with a macro language like Microsoft's Visual Basic for Applications (VBA), you can wire an automation client to an automation server with relative ease. But macro language support is only the tip of the automation iceberg, and those who tout only this one dimension of automation are providing a great disservice.

Next time we'll see how to build an automation client-server pair using Visual Basic and Visual C++.

Richard Hale Shaw is a contributing editor of PC Magazine.

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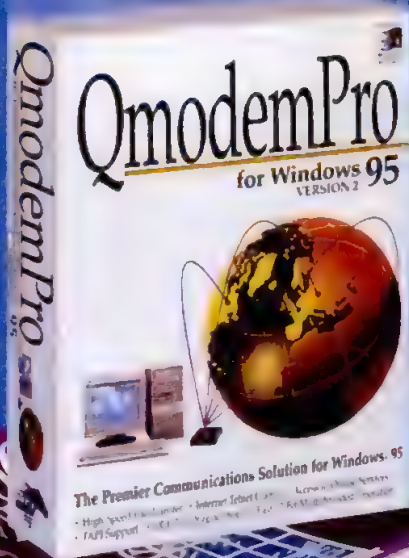
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PC Tech/Power Programming

By Paul Bonner

Remote OLE Automation

Visual Basic 4.0 lets you put data-intensive processes on the server.

Visual Basic's latest incarnation incorporates major changes in everything from the core language dialect to types of applications it can create. That Microsoft Visual Basic 4.0 was designed primarily for use on new operating systems—Microsoft Windows 95 and Windows NT—with scores of their own new capabilities further accentuates this difference. One major new addition, the Remote Automation facility provided in the Enterprise Edition of Visual Basic 4.0, allows any OLE Automation client application to execute an OLE server remotely across a network.

The ability to build OLE Automation servers is one of the key new features of Visual Basic 4.0. It allows Visual Basic programmers to create standalone OLE objects that expose properties and methods to OLE Automation clients (including other Visual Basic applications), just as a Word for Windows WordBasic object or an Excel Worksheet object does.

Up to now, OLE Automation servers had to reside on the same PC as their client applications. With the addition of Remote Automation, however, OLE Automation servers residing on a Windows 95 or Windows NT server can be accessed by client applications running on any Windows 3.x, Windows 95, or Windows NT workstation.

In local OLE Automation, commands from an automation client pass through a *proxy*, which *assembles* (the Microsoft term for *pack* or *encode*) and transmits a message to an OLE stub. This then disassembles (or *unpacks/decodes*) the message and passes the command onto the Automation Server, as Figure 1 shows. OLE automatically provides both the proxy and the stub. Return values from the server pass through the stub and proxy on their way back to the client.

The Remote Automation facility replaces the original OLE proxy and stub with new proxy and stub modules that use remote procedure calls (RPCs) to pass client requests across the network to an Automation Manager running on the server. The Automation Manager passes the client data to the specified OLE server and then passes return data back across the network to the client application, as Figure 2 shows.

The amazing thing about Remote Automation is that it's transparent to both the user and the programmer. You can build and execute an OLE Automation server on your

the client application's setup routine, the user need not perform any extra steps to take advantage of that support.

Remote execution of OLE Automation servers offers several fundamental advantages, including simplified administration and maintenance of shared applications, off-loading of complex computational tasks from client workstations, reusability by any OLE client application, and multiple levels of security for access and data authentication. But its most important advantage, at least from Microsoft's point of view, is the ability of remote OLE servers to act as repositories for business

rules and remote data-access procedures in shared applications.

This capability is key to Microsoft's strategic vision of a three-tiered architecture for enterprise applications, one in which the user interface portion resides on the client workstation, the business logic on a departmental or middle-tier server, and the heavy-duty data-crunching facilities on a SQL database server. The user interface and business tiers are connected by OLE Automation, while the business logic and database tiers are connected using conventional database links.

The three-tier model is of such central importance

to Microsoft's enterprise computing plans that it is just about the only application for Remote Automation that you'll find mentioned in any of the official Visual Basic 4.0 literature. Most of the Remote Automation samples on the Enterprise Edition CD-ROM, for instance, demonstrate variations of a three-tier model in which Visual Basic-based OLE Automation clients and servers ultimately connect to a remote database. Nevertheless, it doesn't take much thinking about Remote Automation to see that it has uses entirely removed from

OLE Automation on a Single Machine



FIGURE 1: In local OLE Automation, commands pass through a proxy to a stub.

Remote OLE Automation

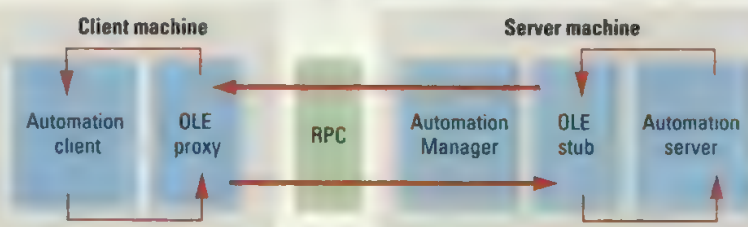
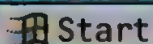


FIGURE 2: Remote OLE Automation requires the intervention of the Automation Manager.

local machine and then adapt it to remote operation merely by moving the OLE Server to a remote PC on which the Automation Manager is running; you then register the OLE Server's new location using the Remote Automation Connection Manager. (Visual Basic 4.0 Enterprise Edition includes both the Automation Manager and the Remote Automation Connection Manager.) The programmer need not change a single line of code to add support for Remote Automation to the client or the server application. And since remote server registration can easily be included in

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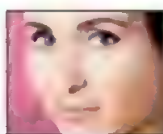
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```

Sub RecordMove (fName$, Path$, DestDir$, uName$)
Dim DB As Database, DS As DynaSet,
[[!cc]] T1 As Table, T2 As Table
Dim sPath%, dPath%
sPath% = GetQueueNum%(Path$)
dPath% = GetQueueNum%(DestDir$)

' Open database and tables
Set DB = OpenDatabase(MyDatabase$)
Set T1 = DB.OpenTable("Files")
Set T2 = DB.OpenTable("Moves")

' Locate fName$ in Files table
T1.Index = "idxFiles"
T1.Seek "=", fName$
T1.LockEdits = False

' Add a new record to Files if Seek fails
BeginTrans
If T1.NoMatch Then 'if file not already in db, then
    T1.AddNew
Else
    T1.Edit
End If

' Always add a new record to Moves
T2.AddNew

' Record move data in Files table
T1("FileName") = fName$
T1("mFrom") = sPath%
T1("mTo") = dPath%
T1("Date") = Date$
T1("Time") = Time$
T1("mBy") = uName$
T1("Path") = dPath%

' Record move data in Moves table
T2("FileName") = fName$
T2("mTo") = dPath%
T2("mFrom") = sPath%
T2("MovedBy") = uName$
T2("mDate") = Date$
T2("mTime") = Time$

' Finish up
T1.Update
T2.Update
CommitTrans
T1.Close
T2.Close
DB.Close
End Sub

```

FIGURE 3: The Copyflow application originally used this simple code to write records to two tables, *Files* and *Moves*, within a shared database.

note client/server databases.

For instance, a three-tier client/server model isn't particularly relevant to the needs of someone who is simply trying to get a multiuser departmental application to move a little faster than molasses. Nevertheless, the concept of partitioning that application into distinct functional chunks, deploying those chunks across the network in the most efficient manner, and linking them all via OLE automation does raise some promising possibilities. In fact, the first thing that occurred to me when I saw Remote Automation demonstrated was that it might be the solution to multiuser database performance problems in a workgroup automation application I had built in Visual Basic 3.0.

The Help file for the VB 4.0 sample applications seemed to support that theory. In an entry describing a server-based OLE object that uses Visual Basic's Jet/DAO data access facilities to access a remote client/server database, the Help states, "In many cases, deploying data access server objects on the same machine as the database engine can greatly reduce network traffic and improve overall data request throughput speed."

What works for remote SQL client/server databases should work just as well for Visual Basic's native Access databases, I reasoned. Putting that theory to the test, I took a scalpel to my workgroup application, partitioning it into two components: a client application designed to handle all interaction with the user

and a server application designed to handle all data access chores. Then I took advantage of Remote Automation to move the server application to the same workgroup server that holds the shared database.

The results were better than I had imagined possible. By nearly eliminating the impact of network performance on database transaction time, this partitioning resulted in a significant improvement in the application's overall performance. Moreover, network traffic was greatly reduced and much more predictable in scope. Perhaps most notably, the experiment left obvious paths for making additional key improvements in an application's performance, which was previously almost completely bound by network performance.

THE PROBLEM

The problem that necessitated this solution began several years ago when I was asked to expand a simple workgroup automation application called Copyflow, originally written in Visual Basic 2.0. The application's original purpose was to simplify the user-initiated movement of editorial documents through a complex series of network queues. When a user wished to move a file and invoked Copyflow from the File menu in Word for Windows or Excel for Windows, it would present the user with a list of valid destination queues (with the most likely destination preselected). When the user selected a destination, Copyflow would copy the file there, make an archival

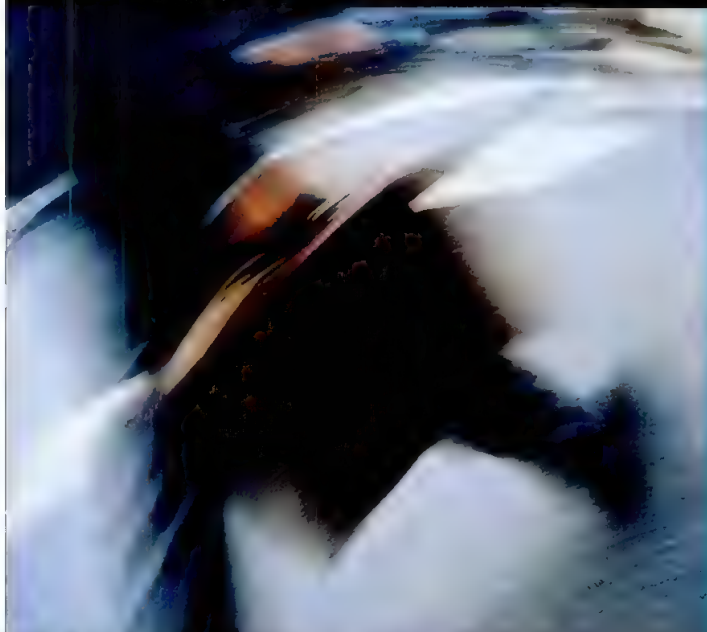
backup, and then delete the file from its original location—thus ensuring that only one "live" copy of the file was present in the editorial queues at any one time. Similarly, when a user wished to retrieve or print a file, Copyflow provided directory listings of the editorial queues for which the user had sufficient rights; it then used Dynamic Data Exchange to instruct Word or Excel to open or print the selected file.

Despite some hairy moments working out the kinks in the DDE interactions between Visual Basic and Word, this application proved to be well within Visual Basic 2.0's capabilities. So when I needed to add centralized file-tracking capabilities to a new version of Copyflow, the then-new Visual Basic 3.0 seemed a natural choice, with its Jet Database Engine, Data Control, and Data Access Objects (DAOs). Especially appealing was the highly scaleable nature of VB's new database tools, which allowed one to mock up an application in the simplest possible manner using data-aware controls and then tune its performance and features through selective injections of more sophisticated methods and objects.

I didn't anticipate that the shared database would have a significant impact on Copyflow's performance. Although as many as 50 users would be running Copyflow at one time, very few would make more than occasional use of its database facilities. A typical user might add a half-dozen records to the database every day—with each move resulting in one or two table writes—and issue even fewer database



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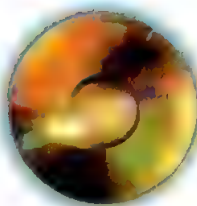
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queries. (Database queries occur only when a user invokes Copyflow's File Search facility or uses the Get Info facility to obtain the history of a particular file.)

My initial performance testing seemed to justify that optimism. But after the new version went into use and the shared data set began to grow, I discovered—as have many other VB developers—that even the mostly lightly used shared database can seriously degrade the performance of a Visual Basic application. Far too much data has to move across the network every time a user touches the shared database—a situation made worse in this case by frequent network overloads.

Much to my chagrin, I realized that the average user's relatively light use of the database actually exacerbated Copyflow's performance problems rather than alleviating them. Infrequent data access meant that almost without fail Windows had swapped the large Visual Basic database DLLs out of memory between one data access and the next, and thus it had to load those DLLs back into memory before Copyflow could even begin moving data across the network.

A TAILOR-MADE SOLUTION

Given this situation, the opportunity to partition the Copyflow application so that all the actual database access routines resided on a network server alongside the data they needed to access seemed heaven-sent. I anticipated that doing so would provide these three distinct advantages over the conventional multiuser-database model employed by the existing version of Copyflow:

- Minimize the impact of network performance on database transaction time. The database routines would be working with a local database, even while acting as remote automation servers for the remaining portion of the application, which would still be running on client workstations.
- Reduce the client application's memory usage by eliminating database access routines—and therefore the VB database libraries—from the client-side application. It remained to be seen, however, how much of that gain would be offset by the need to load additional OLE and RPC libraries.
- Reduce overall network traffic (to the benefit of all network applications and users).

```
Public Sub RecordMove(ByVal fName$, ByVal Path%, ByVal
DestDir%, ByVal uName$)
' Open tables and select indices
Set FilesTable = MyDB.OpenRecordset("Files", dbOpenTable)
FilesTable.Index = "idxFiles"
MyWS.BeginTrans
Set MovesTable = MyDB.OpenRecordset("Moves", dbOpenTable)
fName$ = LCase$(fName$)
MovesTable.Index = "idxMoves"

' Add a new record to Files if Seek fails
With FilesTable
    .Seek "=", fName$
    .LockEdits = False
    If .NoMatch Then 'if file not already in db, then
        .AddNew
    Else
        .Edit
    End If
End With

' Record move data in Files table
!filename = fName$
!mFrom = Path%
!mTo = DestDir%
!Date = Date$
!Time = Time$
!mBy = uName$
.Update
End With

' Record move data in a new MovesTable record
With MovesTable
    .AddNew
    !filename = fName$
    !mTo = DestDir%
    !mFrom = Path%
    !MovedBy = uName$
    !mDate = Date$
    !mTime = Time$
.Update
End With

' Finish up
MyWS.CommitTrans
dbClose
End Sub
```

FIGURE 4: This new version of Copyflow's RecordMove routine reflects changes in Version 3.0 of the Jet Database Engine and uses the new With...End With construct to simplify references to fields within each table.

Storing parameter-query definitions in the database tables would ensure that the largest transaction coming from the client side would be no more than a couple of dozen bytes. And since the remote OLE Automation server would return only the results of queries, it would be rare for more than a kilobyte or two of data to flow back to the workstation.

My biggest concern about the new split architecture was the extent to which OLE and RPC overhead would offset these potential performance gains. This concern was heightened by the need for Copyflow to run in a mixed 16- and 32-bit environment. The Remote Automation Manager, and thus remote

OLE Automation servers, can run only on 32-bit versions of Windows, but most of Copyflow's client workstations would likely continue to use 16-bit Windows for the foreseeable future. While 16-bit OLE Automation clients can use remote 32-bit OLE Automation servers, the VB documentation counsels that a 32-bit to 32-bit link is considerably more efficient. Given these considerations, I decided to go ahead and split the existing Copyflow application into the two pieces described above and to test its performance on a small, mixed 16- and 32-bit network.

The first step in any partitioning project is deciding which code should end up where. My goal was to get all the database access routines out of the client component and to eliminate entirely the need for the client to load any of VB's database DLLs. To do so, I had to excise not only any code that made calls to Jet's database update or query mechanisms, but also any reference to table or record objects and any use of the Data Control and data-bound fields.

Fortunately, Copyflow had only three data access routines: RecordMove, which wrote a database record after each file move; SearchDB, a search routine that Copyflow's Find File facility used; and another search routine built into a routine called LoadSequence, used by the Get Info file history screen. In addition, the Get Info screen used a Data Control and several bound Text and Label controls.

MOVING THE RECORDMOVE ROUTINE

The simplest of these to relocate to a remote server was the RecordMove routine, since it was written



as a subroutine with no return value rather than as a function. The original RecordMove routine used Data Access Objects to write records to two tables, called Files and Moves, within Copyflow's shared database using the fairly straightforward code in Figure 3. Since nearly every line of the original RecordMove routine made use of DAOs, it was destined to move nearly in its entirety to the new OLE Automation database server. To accomplish that, I created a new project called DBSVR.VBP in the 32-bit Enterprise Edition of Visual Basic 4.0. I immediately added a class module to the project, creating within it a public class called cfDBSVr.

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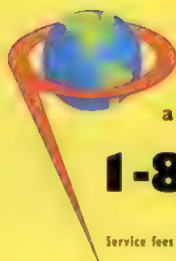
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Then I proceeded to re-create the existing RecordMove subroutine in a public routine within the class module. In doing so, I modified the old code to reflect changes in Version 3.0 of the Jet Database Engine (for instance, replacing OpenTable commands with OpenRecordset commands issued with the dbOpenTable parameter) and using the new With...End With construct to simplify references to fields within each table (see Figure 4).

The parameter clause of the Sub's definition statement has two aspects worth noting. One is the simple fact that the routine takes parameters. A more objectlike approach would have the cfDBSvr class expose a set of properties for Filename, Path, DestDir, and so on, the values of which the OLE client would set prior to calling the class's RecordMove method. That method would add the OLE Automation overhead, however, plus the overhead of an RPC call to each property-setting operation—and thus would be considerably slower than simply passing all the parameters in a single call to the class's RecordMove method.

The other point worth noting is that each of the parameters is declared ByVal as opposed to ByRef. When working with a local OLE server, parameters passed by reference would be more efficient, because only the address of the client's data would be passed. With Remote Automation, however, the server does not have access to the memory space of the client. A ByRef parameter must be copied across the network, passed to the server, and then copied back, whether or not the routine on the server actually modified it. When a parameter is passed by value, it need only copy the data to the server once.

Having moved the guts of the original RecordMove routine to the OLE Automation server, I was able to cut down the RecordMove routine considerably in the new client application, without changing its parameters or modifying the code used to call it from other routines in the client application:

```
Sub RecordMove(fName$, Path$,  
    ➤DestDir$, uName$)  
    Set MyDBObj = New cfDBSvr  
    MyDBObj.RecordMove fName$,  
    ➤GetQueueNum$(Path$),  
    ➤GetQueueNum$(DestDir$), uName$  
    Set MyDBObj = Nothing  
End Sub
```

THE SEARCHDB ROUTINE

Next, I tackled the SearchDB routine. In its original form, this routine passed the contents of a text field (Text1) as a parameter to a stored QueryDef. The text field contained the file specification entered by the user, and the QueryDef returned the name and path of every file matching that specification

from the Files table.

Once the data had been obtained, the routine simply looked through each returned record and added fields to a found-files list box, as shown here:

```
Sub SearchDB ()  
    Test$ = Text1  
    ' Open Snapshot Query using stored  
    ' Parameter QueryDef  
    Dim MyQuery As QueryDef, SN as  
    ➤Snapshot  
    Set MyQuery = Db.OpenQueryDef("A  
    ➤Name")  
    MyQuery!MyParam = Test$  
    Set SN = MyQuery.CreateSnapshot()  
    SN.MoveFirst  
    ' Loop through Snapshot  
    Do While Not SN.EOF  
        '...  
        '... code to move data from each  
        '... record in SN  
        '... to found files list box removed  
        '... for space purposes  
        '...  
        SN.MoveNext  
    Loop  
End Sub
```

While there was no need for the server-based version of RecordMove to return a value to the OLE Client, SearchDB very definitely had to do so. Clearly, when this function was partitioned, the server would need to return the results of the Snapshot query to the client application. The major issue then was what form those returned results should take. Returning the Snapshot was out of the question, since that would introduce a data access object into the client application, requiring the client to load the VB database libraries. What's more, the Remote Automation documentation specifically counsels against passing Jet DAOs across the network. It recommends that you instead pass small query result sets in the form of a Variant array, so that's what I did. The new SearchDB method in the OLE Automation server's cfDBSvr class calls the stored query then loops through the result set, copying the two fields from each returned record to a Variant array in the form of a comma-delimited string (Figure 5).

On the client side, meanwhile, I rewrote SearchDB to call the SearchDB method in cfDBSvr, assigning its return value to a Variant called Test. If the SearchDB method finds any records that match the user-supplied file specification, Test will be a string array. If no records are found, the routine exits. SearchDB uses the VarType function to determine whether Test is a string array. If it is, SearchDB proceeds to loop through the array, extracting the returned data from each record and adding it to the found-files list box:

```
Private Sub SearchDB()  
    ' Call the SearchDB method in cfDBSvr  
    Dim MyOwnBob as cfDBSvr, test As  
    ➤Variant  
    On Error GoTo 0  
    ' Make sure the return set isn't empty  
    test = MyOwnBob.SearchDB(Text1)  
    If VarType(test) < (vbArray +  
    ➤vbString) Then Exit Sub  
    ' Loop through return set  
    found% = UBound(test)  
    For counter% = 1 To found%  
        a$ = test(counter%)  
        '...  
        '... each record in array is a comma-  
        '... delimited string  
        '... containing requested fields, so  
        '... parse a$ and apply  
        '...  
    Next  
End Sub
```

THE GET INFO FORM

Moving the database access facilities used by Copyflow's Get Info form to an OLE Automation server posed some special challenges. The original form mixed two Data Controls, a handful of bound text fields, and some SQL statements to obtain and display data about a file, including its current location and a list of all its moves through the network. So to move the form's data access routines to an OLE Automation server, I had to unbind the Text fields, remove the Data Controls, and add code to the client-side routine to populate the Text fields using the data returned by the OLE Automation server.

Another complication here was that having reset the Data Control record sources and updated the Data Controls, the original routine would check the contents of a bound field that should contain the name of the file for which information was being provided (Figure 6 shows the routine, with unrelated code removed). If that field was empty, indicating there was no record of the specified file in the Files table, the routine would use the bound Data control to add a new record to the table.

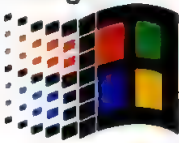
Since there would be no Data control present in the new version of this routine, I had to find another way to handle information requests on files for which Copyflow had no record. Thus, the new client-side application uses the VarType function to determine whether the Variant returned by the original call to cfDBSvr's GetFileInfo method reflects an empty data set; if it does, VarType calls the class's RecordMove method to create an initial record for the file before calling the GetFileInfo method again.

PRELIMINARY TESTING

Once the partitioning was done, I compiled the new client application and the OLE Automation server as 32-bit executables and

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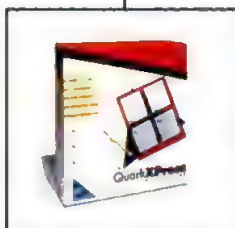
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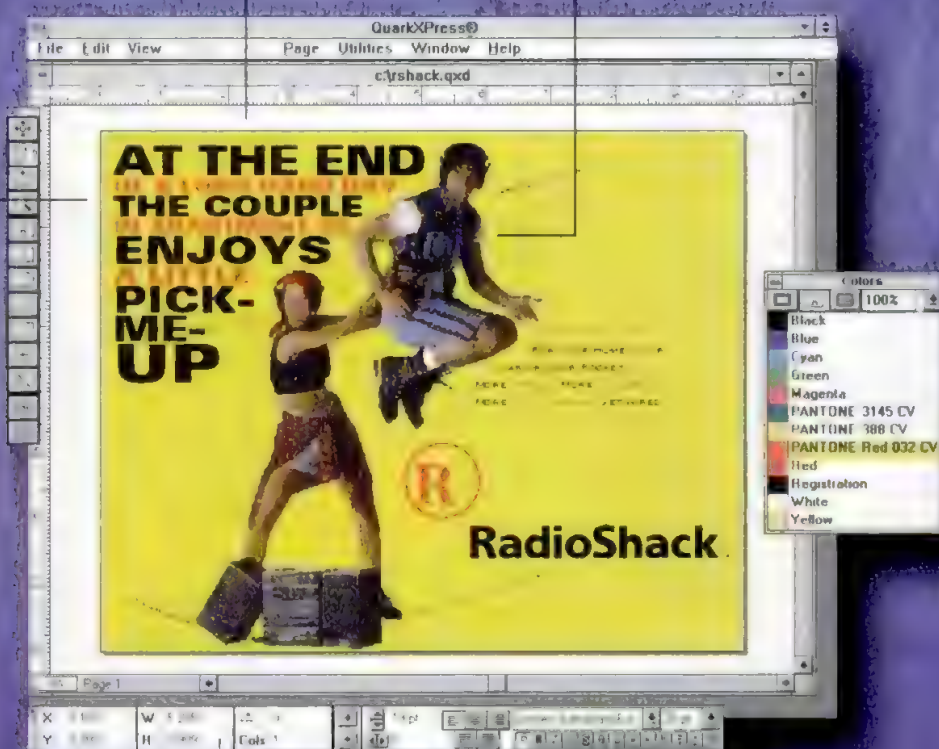
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launched both on a single Windows 95 workstation. Then, having determined that the links between the two were functioning correctly, I moved the client application to another Windows 95 workstation. The workstations were connected by Ethernet cables and both were running Client for Microsoft Networks.

I then launched the Automation Manager on the OLE Automation server PC to enable remote requests to that station, and I launched Remote Automation Connection Manager on both PCs. On the server PC, I used Connection Manager to allow remote requests to the OLE Automation server component of the newly partitioned Copyflow application; on the client side, I used Connection Manager to specify the server software's network location. Once again, testing indicated that the links between client and server functioned perfectly, and I was happy to see little or no performance degradation imposed by the cross-network connection.

Unfortunately, testing a 16-bit version of the client software didn't proceed as well. The 16-bit client was able to interact with a local 32-bit server perfectly well, but failed time after time to make a connection when I tried to link it to a remote server. It took nearly two weeks of testing, endless reinstallations, dozens of plaintive requests for help in various on-line forums, and several tech support calls to determine the cause of the problem: a previously unknown bug that prevents 16-bit clients from communicating with 32-bit servers over NetBEUI, the protocol that Microsoft Networking clients use in Windows for Workgroups and Windows 95.

As of this writing, Microsoft acknowledges the bug, but has been unable to suggest a workaround or solution. In the meantime, Microsoft reports that 16-bit to 32-bit connections work flawlessly over TCP/IP, NetWare LANs, and every other network protocol tested.

PERFORMANCE

Further testing on a larger scale is obviously needed before I can draw any firm conclusions about the performance of the newly partitioned version of Copyflow compared with the earlier version, but the initial indications are very promising.

As expected, the increased efficiency of the

client application's data queries, combined with the small size of the returned data sets, seems to all but eliminate the impact of network performance on the Copyflow application while reducing overall network traffic. The typical Find File query returns just 10 to 15 bytes of data per matching file, while the average Get Info query returns about 30 bytes of data.

Eliminating the client application's dependency on the Visual Basic database libraries has also, as expected, had beneficial effects. The combined file size of executable-file and

no memory cost to Copyflow's use of OLE libraries that Word for Windows—the application with which Copyflow is most frequently used—has already loaded into memory.

Although OLE and the RPC libraries do impose some overhead, its impact appears to be both minimal and predictable. In contrast, the extent of the performance impact of moving ever-larger data sets across a network already prone to sporadic bandwidth overloads was entirely unpredictable.

Being able to assume a reasonable performance cost for the new version of Copyflow's

cross-network operations—2 to 3 seconds, perhaps, as opposed to previous delays of 2 to 45 seconds (depending on the nature of the operation and current network load)—allows you to plan other enhancements with more confidence. Certainly the application's improved database performance makes it possible to consider broadening Copyflow's data-gathering functions—something that was unthinkable given the performance problems of the old, unpartitioned application.

The partitioning concept also offers further opportunities for enhancing Copyflow's performance. For instance, it would be relatively simple to create a store-and-forward OLE Automation server that would run on the client workstation with the express purpose of accepting record-writing requests from the client software and then forward them to the remote OLE Automation server when the server was free from other requests. From the user's point of view, this would all but eliminate any delay during data-write operations, since the client workstation software wouldn't need to pause while the cross-network connection was made to the Remote OLE Automation server.



```
Public Function SearchDB(ByVal test$) As Variant
    ' Open Parameter Query
    Dim tmp() As Variant, SN As Object
    Set ParmQD = MyDB.QueryDefs("A Name")
    ParmQD.MyParam = test$
    Set SN = ParmQD.OpenRecordset(dbOpenDynaset)

    ' Using returned result set...
    With SN
        On Error Resume Next

        ' Count returned records
        .MoveLast
        On Error GoTo 0
        recCount% = .RecordCount
        If recCount% = 0 Then Exit Function

        ' Copy returned records to Variant array
        ' as comma-delimited strings
        ReDim tmp(recCount%)
        .MoveFirst
        For Counter% = 1 To recCount%
            tmp(Counter%) = IIf(filename & comma$ & IPath & " + comma$ & Y%
            .MoveNext
        Next Counter%
    End With

    ' Finish up
    SearchDB = tmp()
    Set ParmQD = Nothing
    Set SN = Nothing
End Function
```

FIGURE 5: Here is the new SearchDB method in the OLE Automation server's cfDBsvr class.

runtime libraries for the Visual Basic 3.0 version of Copyflow (including the database libraries) and the Visual Basic 4.0 version (which omits the database libraries but adds OLE and RPC libraries) is about 2MB in each case. Total file size doesn't reflect the actual memory impact of the two versions, however, since almost all the OLE-related libraries required by the Visual Basic 4.0 version are also loaded and used by Word for Windows.

When you load an application that requires a DLL already in use by another application, Windows does not load a second copy of the DLL; it merely increments the instance count of the first loaded copy. Thus, there is little or

Of course, any kind of write-delay caching introduces some risk to your data, but in most cases the actual delay using this mechanism would be a few seconds at most, thus minimizing that risk while still eliminating an annoying lag in response time.

There are also several options for increasing server-side performance. One would be to implement a pool of server applications, with a Pool Manager application to spread the work around among the different servers. Alternatively, I could implement different servers for each of the three data access operations—thus ensuring, for instance, that a quick RecordMove operation is not delayed

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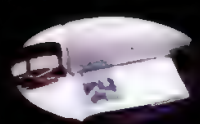
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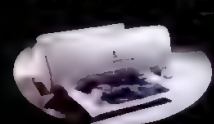
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CIRCLE 231 ON READER SERVICE CARD.

by a more time-consuming GetFileInfo search.

Without Remote OLE Automation, my only alternative to Jet's miserable cross-network performance seemed to be upsizing to a full client/server DBMS—a move that seemed like overkill for this relatively simple

and data-lite application. Remote OLE Automation offered Copyflow a simpler and more flexible way to get rid of the performance doldrums, and it bodes well for the future of many applications whose performance or capabilities can be improved by

adopting a partitioned architecture. □

Paul Bonner is a Boston-based freelance writer, systems consultant, and specialist in visual programming. He can be reached at pbonner@zd.com.

ORIGINAL LOADSEQUENCE:

```
Sub LoadSequence ()
' Use Data Controls to retrieve info about file in
' FileDef$
Data1.RecordSource = SQL$ + FileDef$
Data1.Refresh
MovesData.RecordSource = MovesSQL$ + FileDef$
MovesData.Refresh
x%=DoEvents()
'if bound file name field is empty, add a new record to
'Files table
If Label14(0) = "" Then
    Data1.Recordset.AddNew
    ...
    ... populate bound fields for new record
    ...
    Data1.Recordset.Update
    ' Restart the routine
    Data1.Refresh
End If
' ...
' ... populate unbound controls with additional data
' ...
End Sub
```

NEW SERVER-SIDE LOADSEQUENCE:

```
Public Function GetFileInfo(ByVal InfoRequestFile$) As
Variant
Dim Moves() As Variant, mm As Object
FileDef$ = ExtractFileName(InfoRequestFile$)
' new routine replaces two Data Controls in original with
' a single stored parameter query which retrieves fields
' from both Files and Moves table:
' Stored QUERYDEF named FilesAndMoves:
' PARAMETERS myfile Text;
' SELECT Files.Path, Files.Issue, Moves.*
' From Files, Moves
' WHERE Files.FileName=[myfile] And
' Files.FileName=Moves.FileName;
' Issue query
Set ParmQD = MyDB.QueryDefs("FileAndMoves")
ParmQD!myfile = FileDef$
Set mm = ParmQD.OpenRecordset(dbOpenDynaset, dbReadOnly)
' Count records in returned data set
With mm
    On Error Resume Next
    .MoveLast
    On Error GoTo 0
    recCount% = .RecordCount
    ' Redim variant array to record count + 3
    ' leaving room for data from files table in
    ' first two array elements, then stuff Moves
    ' table data in remaining elements
    If recCount% <> 0 Then
        ReDim Moves(recCount% + 3)
```

```
Moves(1) = !Path
Moves(2) = !Issue
For Counter% = 2 To recCount% + 2
    Counter% = Counter% + 1
    Moves(Counter%) = !mFrom & comma$ & !mTo &
        comma$ & !MovedBy & comma$ & !mDate & comma$ &
        !mTime
.MovePrevious
Next
    GetFileInfo = Moves()
End If
End With
' Finish up
mm.Close
Set mm = Nothing
Set ParmQD = Nothing
End Function
```

NEW CLIENT-SIDE LOADSEQUENCE:

```
Private Sub LoadSequence()
' Call GetFileInfo method
Dim FileData As Variant, arrSize%
FileData = MyDBObj.GetFileInfo(InfoRequestFile$)
' If return val isn't a string array
' Call RecordMove to create an initial record
' for file, then repeat call to GetFileInfo
If VarType(FileData) < (vbArray + vbString) Then
    Screen.MousePointer = 0
    Set MyDBObj = Nothing
    Set FileData = Nothing
    x% = DoEvents()
    Set MyDBObj = New cfdBsvr
    MyDBObj.RecordMove ExtractFileName$(InfoRequestFile$),
    99, GetQueueNum$(ExtractFilePath$(InfoRequestFile$)),
    uName$
    Set MyDBObj = Nothing
    x% = DoEvents()
    x% = DoEvents()
    x% = DoEvents()
    Set MyDBObj = New cfdBsvr
    FileData = MyDBObj.GetFileInfo(InfoRequestFile$)
End If
' Extract data from returned Variant array
arrSize% = UBound(FileData)
fPath$ = FileData(1)
fIssue$ = FileData(2)
For x% = 3 To arrSize%
    MoveData = FileData(x%)
    If MoveData = "" Then
        ...
        ... fill in fields on GetInfo screen
        ...
    End If
Next
End Sub
```

FIGURE 6: The old and new code behind Copyflow's Get Info form.

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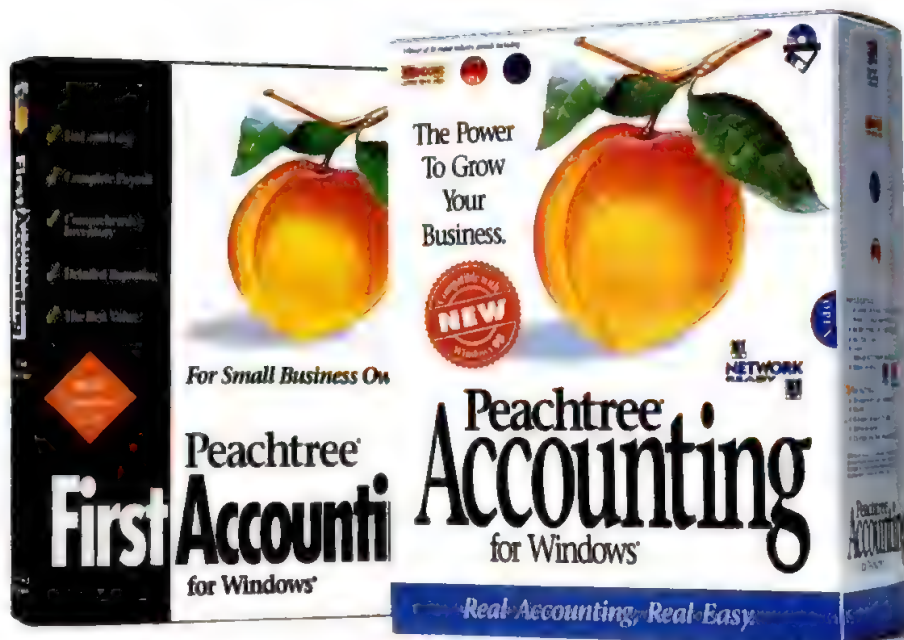


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CIRCLE 393 ON READER SERVICE CARD



By Sean González

Scripting the Web

How CGI scripts can make the World-Wide Web truly interactive.

A few years back, there was a craze for "interactive books"—game programs in which you'd skip to a specific page in the book, based on some choice you had to make. Without scripting, the Web would be only as interactive as one of those games. Content laid out in this way is called *browsable* content. Although it's quite useful for some applications, this format can be very restrictive and does not allow for true interactivity. With only browsable content, your Web experience would be limited to the preconceived scenarios of the Web-site author.

Scripts permit two-way interaction between the Web site and the user browsing the site. This gives Web-site authors a lot more flexibility: They can write scripts that obtain specific information from you and act on that information. A script can even be used to build games and other interactive programs.

GETTING TO KNOW YOU: CGI SCRIPTS

A CGI (Common Gateway Interface) script is a program that can yield the same results all the time or results that vary depending on the user's input. The CGI defines a standard way to obtain input (either from a form or from the URL that invoked the script) and to return the output of the script to the Web browser. CGI scripts can be written in either an interpreted scripting language (such as Perl, the various Unix shells, or DOS batch files) or a compiled programming language like C or Visual Basic.

A CGI script can be invoked either directly when the user clicks on a link or after the user fills out a form, which the server processes after the submit button on the form is pressed. Whether via a link or a form, how a script will be invoked and what it will do is entirely up to the Web-site author. If you plan to build interactive content with scripts that use input from

forms, you must keep in mind that not all browsers are forms-enabled. Also keep in mind that your Webmaster must authorize CGI scripts before they can execute, as these programs run on the Web server and, like any other

er—which occurs every time a URL on the server is accessed—the server has no way of correlating the new URL request to previous ones. To a Web server, a URL request from user A is indistinguishable from a URL request from user B; furthermore, user A's first request is completely unrelated to his or her subsequent requests.

A Web transaction occurs as follows: The Web client makes a connection to the server and delivers its URL request. The server acknowledges the request and sends the requested information (an HTML, .GIF, or other kind of

file) to the Web client. The connection is then terminated, leaving no trace of information about the request (with the possible exception of an activity log, but that information is not known to the running Web-server software). New requests will require that the process be repeated in its entirety. Because the server does not keep track of past connections and requests, the server cannot build state information for a client; that is, the server has no memory about what the Web client has requested or done.

STATE FROM STATELESSNESS

How does the lack of state information affect you and your ability to build interactive applications on the Web? Consider a game of hangman (see Figure 1). Writing an HTML page to display the game is trivial. A simple implementation requires a graphic and the letters of the alphabet, where each letter is a link to a URL that invokes the hangman script on the server. The Web

user then clicks on the letter "A" as a first guess. The URL looks something like this:

```
http://host.name/cgi-bin/
hangman?this_guess=A
```

The value "A"—in the variable `this_guess`—is passed to the CGI script `hangman`. Using this information, the CGI script takes appropriate action; it figures out whether "A" is a correct guess and redisplay the hangman. Note the use of `cgi-bin` in the URL. This is a common URL notation used by Webmasters to point to a directory where CGI scripts are located on their system.



FIGURE 1: An example of a hangman game that uses CGI on the World-Wide Web. Note the URL for the hypertext link being pointed to.

program, could compromise the server itself.

At its simplest, CGI defines how input from the user will be available to the script: either through environment variables (if forms are used) or as parameters (if the information is provided as part of the URL that invokes the script). All output generated by a CGI script must be in HTML format so that the browser can display it.

WHAT STATE ARE WE IN?

One of the biggest problems of CGI scripts (and of the Web in general) is the lack of state information about a connection. That is, when a browser makes a connection to a Web serv-

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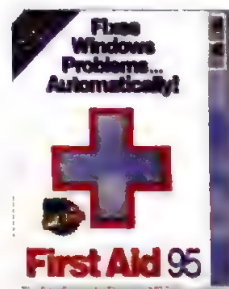
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Because no state information is retained, when the Web user makes a second guess, the server no longer knows that the user has already guessed "A"! One way to deal with this problem is to embed the previous responses into the URLs that take new actions. Using this approach, when you click on "B" as your second guess, the URL that transmits the "B" as a response to the CGI script really transmits both "A" and "B" (that is, your first and second guesses) and continues to concatenate your answers for each subsequent guess. A sample URL that would transmit current and previous guesses to the script would look like this:

```
http://some.host.name/cgi-bin/hangman?  
➔this_guess=B&previous_guesses=A+C
```

where the hangman script will receive a variable `this_guess` with value "B" and a variable `previous_guesses` with value "A+C"; the hangman CGI script can then parse these variables to extract both new and previous responses.

Adding your previous responses to URLs, however, means (1) having to rebuild all of the HTML pages on the fly to insert the previous responses into each URL (in our hangman example, each time you make a guess the URL behind every letter gets rewritten to include previous guesses) and (2) transmitting very large URLs to the server. Depending on the number of links on a page (each of which needs to be rewritten on the fly) and the number of previous responses, this approach can be quite inefficient.

A workaround to this problem is to assign a session ID and keep a client's responses stored in a temporary file for that session ID. The session ID is then inserted into the links on the page; the URLs send the new response together with the session ID. Using this method, each letter in the hangman page would contain a URL that looks something like this for the letter "A" guess, assuming the session ID is 1234:

```
http://some.host.name/cgi-bin/  
➔hangman?ID=1234&this_guess=A
```

Although the link URLs need to be written once on the fly to include the appropriate session ID, they do not need to be rewritten every time the client makes a guess.

When the server receives this URL response, it can open the file containing state information for session ID 1234, restore the previous state, apply the new input, take appropriate action (redisplay the appropriate hangman graphic), and store the new state information in the state file. One disadvantage of this approach is that you have no way of knowing whether the client has gone away and will not return to resume the ses-

sion, so you must implement an inactivity timer to delete the state files; otherwise, you could end up with a lot of stale files on your system!

Purchase-order systems are an example of how the lack of an inactivity timer can result in problematic applications. In a Web store area, you enter items into the order form but then change your mind and decide not to make a purchase at that time. A few months later, you return to the site and want to make a purchase. Your previous order is still on the system! Some sites that exhibit this problem may not even let you clear your purchase order or make corrections to it. Now what do you do? A common reaction is to go away and

The two emerging software solutions that address the performance problem of CGI scripts are the Netscape Server API and Java.

never return to this problem site.

Implementing an inactivity timer can be as easy or complicated as you want. Using Unix, you can set up a cron job (that is, an automated job that executes at pre-established time intervals) that checks the last modification date and time of all state files and removes those that have been on the system longer than some arbitrary time period. You can do this with a single command. Other operating system or application needs may require writing a cleanup program to remove the state files. Whatever method you choose, make sure to pay attention to cleaning up your state files to avoid frustrating your Web users.

TO CGI-SCRIPT OR NOT TO CGI-SCRIPT

Performance can be an important issue when working with CGI scripts. As described above, a Web client makes a connection to the Web server, and the Web server satisfies the client's URL requests. The computation is all done on the server, where the system resources necessary to run the server process have already been spent. CGI scripts execute outside the context of the Web server process, however; that is, new system resources must be invested to create the operating context necessary to run a new program, in this case the CGI script itself. Under multitasking operating systems, this entails creating what is called a *process*, and it is one of the most resource-

intensive activities of a system.

If you have a lot of CGI scripts executing on a server, your system will spend a lot of time creating and deleting the necessary processes to execute your scripts. This can quickly affect overall system performance, to the point of making your Web server sluggish or even unusable. When you get to that point, you will either need to add more hardware (typically more memory or a faster CPU) or find some software solution. The two emerging software solutions that address the performance problem of CGI scripts are the Netscape Server API and Java.

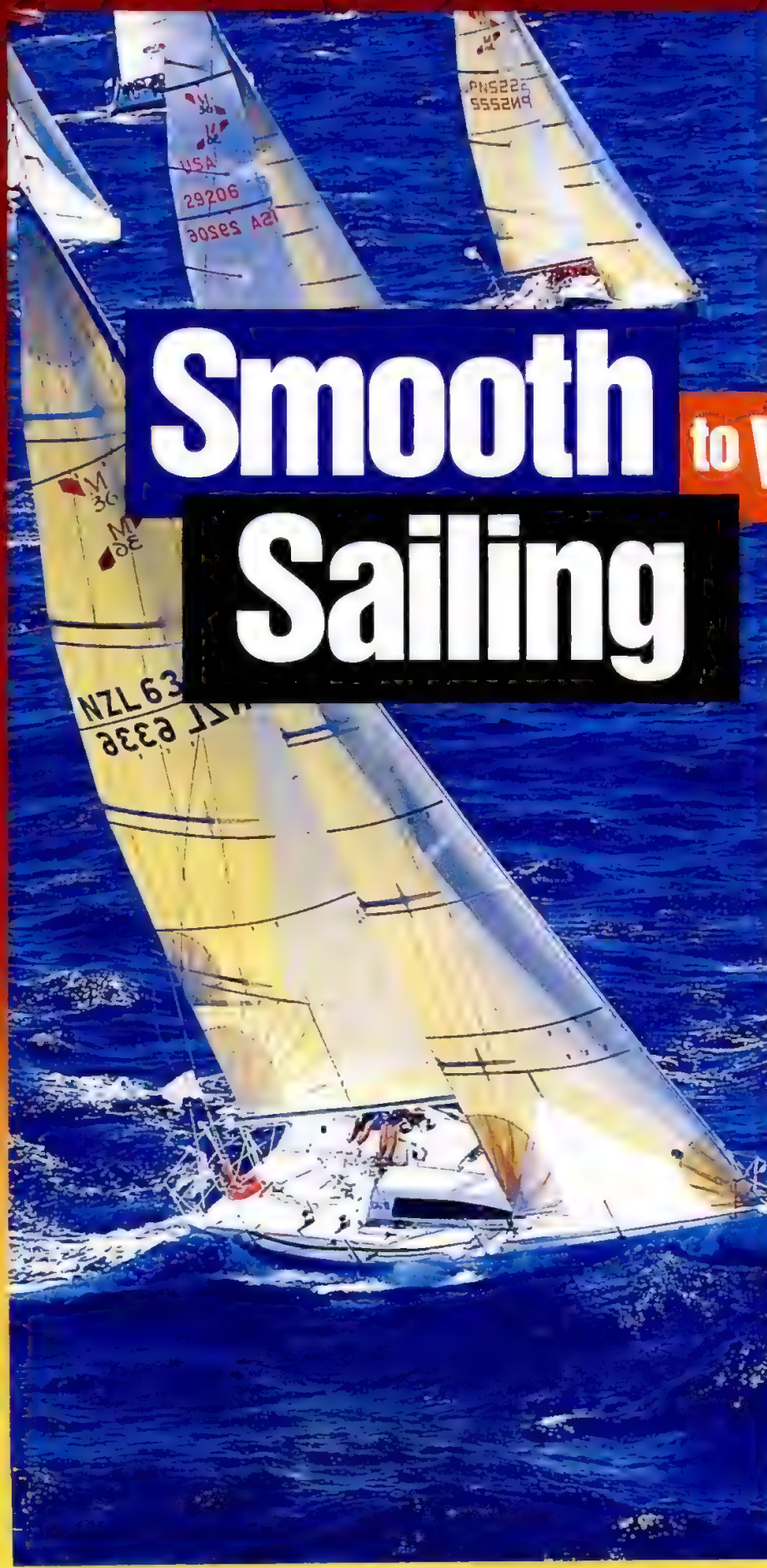
The Netscape Server API provides a mechanism by which your programs can be executed within the context of the Web server process itself, as if they were part of the server code. To accomplish this, your programs are stored as code libraries to which the server can dynamically link; that is, the server code can dynamically access and execute the routines defined in these libraries. Note, however, that to use the Netscape API, you need to be running a Netscape server, and you need to modify the server configuration files to include your software libraries.

The Java programming language (see the Internetworking column of October 24, 1995) approaches the problem from the opposite angle: from the browser. Instead of making the server do more work more efficiently, the Java programming language allows Java-aware browsers to execute programs within the context of the browser. The programs are transmitted to the browser as part of the data stream, so the task of the server is reduced to serving HTML documents and these programs, called *applets*, to the browsers. This mechanism does not obviate the need for scripts (or the Netscape API) on the server to fulfill functions like submitting registration forms or performing searches and other database manipulations, but it does allow the browser to run interactive programs independently of the server once the applet has been transmitted.

THE FUTURE OF THE WEB

Whether you use CGI scripts, the Netscape Server API, or Java, the important thing is that the Web is evolving into a truly interactive information exchange medium. The statelessness of the Web has presented obstacles to making the Web more interactive more quickly. But, as software developers deliver new ways for Web servers and clients to interact, you can expect that a client/server environment will evolve to allow true interactivity between Web servers and browsers. □

Sean González, a regular contributor to our Internetworking column, is a project leader for the Internetworking Solutions group at Information Access Center in Boston.



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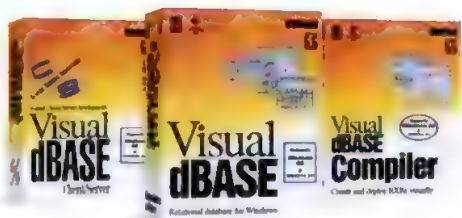


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TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

User-to-User

By Neil J. Rubenking

Faster Restart for Windows 95

Windows 95 has built-in support for shutting down and restarting a computer. The restart process actually involves re-setting the system just as if the reset button had been pressed after a system shutdown. But in many situations, this may be overkill. Perhaps all you need is to reinitialize Windows, maybe after installing a piece of software or after a serious program crash. Here's how to restart Windows 95 without going through the entire cold reboot process.

Run Notepad and type just "@exit" on a line, then save the document as **RESTART.BAT** in any folder you want. Open that folder or find the file using Explorer, right-click on **RESTART.BAT**, and select **Properties** from the menu. Click on the **Programs** tab and check the "Close on exit" box. Press the **Advanced** button and check the "MS-DOS mode" box. Press **OK**, then press **Change Icon...** if you want to use a meaningful icon for this little utility.

Now you can double-click this program to restart Windows 95 quickly. Better yet, drag it onto the **Start** button to put it on the **Start** menu.

BRUNO COSTA, Port Jefferson, New York

PC MAGAZINE: On some systems (mine included), the restart accomplished by this minuscule batch file isn't visibly different from the restart accomplished by choosing **Shut Down...** from the **Start** menu, selecting "Restart the computer," and pressing **OK**. Still, it has the virtue of fast access. To further speed the process of restarting with **RESTART.BAT**, open its **Properties** again, press the **Advanced** button on the **Program** page, and remove the check next to "Warn before entering MS-DOS mode." Right-click on **RESTART.BAT** again, select **Create Shortcut** from the menu, and drag the resulting shortcut onto the desktop. Now restarting Windows 95 is as quick as double-clicking an icon on the desktop.

You need a true Windows restart when you've changed certain system settings or when a crashed program has left the system in an unstable state, perhaps by leaving a copy of a single-use support DLL loaded in memory. If what you really want is simply to shut down all

running programs, there's a faster way. Select **Shut Down** from the **Start** menu, choose "Close all programs and log on as a different user," and press **OK**. You'll be prompted to enter a user name and password. If you've defined a password, enter it. Press **OK** and you're back in Windows 95 with no programs open.

Take Control of the Windows 95 Welcome Screen

Windows 95 is still a new experience for most users, and the tips displayed in the Welcome screen program can be quite helpful. But if you're having a bad day, perhaps being forced to restart frequently, the Welcome screen may become more annoying than helpful. You can easily discard it; just uncheck the box that says "Show this Welcome Screen next time you start Windows." But what if you relent and decide you *want* the Welcome screen? As it turns out, not only can you get it back, you can control the tips it displays.

To restore the Welcome screen, choose **Run** from the **Start** menu, type **welcome**, and click on **OK**. The Welcome screen appears! Check off the check box and press **Close**. Now Windows will display the screen each time you start up.

Changing the list of tips is almost as easy. Select **Run** from the **Start** menu and run **Regedit**, the Registry editor. Press **Ctrl-F** and search for **Tips**; when you find it, press **F3** to search for the second occurrence. You'll know when you've found the right one, because the right-hand half of the window will display a long list of tips (see Figure 1). Select **Export Registry File** from the Registry menu and export the tips to a file called **Oldtips.reg**. You now have a text copy of all the tips used by the Welcome screen.

Copy **Oldtips.reg** to **Newtips.reg** (save the old file in case you want to restore the original tips) and edit the tips in **Newtips.reg** as you please. Don't meddle with the first three lines, as they indicate just what the rest of the file contains. Tip lines start with a number in quotation marks followed by an equal sign and then the tip in quotes. You can replace or edit the existing tips or add more of your own at

HIGHLIGHTS



OPERATING ENVIRONMENTS

Prevent nonexpert users from breaking out of your system's start-up procedure and changing configuration settings. *Page 280*



WORD PROCESSING

The Winword .concept virus has been big news lately. Find out how it works and how to protect yourself from infection. *Page 286*



DATABASES

Add the current date and time to any Microsoft Access form's caption or even to a dedicated control. *Page 298*

OUR ADVISORS

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PC DIRECT starts here with exciting offers from top direct vendors. See index, page 274



FIGURE 1: The tips shown in the Welcome screen are stored in the Windows 95 Registry.

the end, as long as you keep the numbers in sequential order.

When you're done, save *Newtips.reg* and flip back to Regedit. Select *Import Registry File* from the Registry menu and import the file *Newtips.reg*. Regedit will merge your new tips into the Registry. From now on, the Welcome screen will draw from your list of tips. (You could even include this tip!)

Updating User Names In Windows

To change the user or company name in Windows 3.1, you could modify *USER.EXE* with a binary file editor, but there's a much easier way: Just run the Windows setup program with the /F switch. You'll need to do this within Windows, so choose *File | Run in Program Manager* and enter *WINSETUP /F*. Change the user name and company name at the first prompt, then keep hitting *Continue* until you're asked to insert a disk. At that point, hit *Exit*. Both *WINSETUP* and Windows will shut down, so be prepared. Next time you start up, the *Help | About Program Manager* screen should show the new information.

If you're running Windows for Workgroups 3.11, the task is even easier. In the Windows directory you'll find a file called *SERIALNO.INI* that holds the name and company information. Just edit this file to insert the correct information.

DON LEBOW, Lahaina, Hawaii

PC MAGAZINE: If your computer was originally set up by someone else, *Program Manager's Help | About* screen probably shows that per-

son's name and company. Not a big deal, but it can be annoying. You can also run *WINSETUP /F* to update the user information in Windows for Workgroups, and this updates both *USER.EXE* and *SERIALNO.INI* as well. If the names in these two files are different, the ones in *SERIALNO.INI* will be used. It seems that *USER.EXE* strings are retained only for compatibility with older programs.

In Windows 95, you'll find user name information stored in the all-important Registry. Launch the Registry Editor, choose *Find* from the Edit menu, and search for the string *RegisteredOwner*. Double-click the found key and enter your name, then double-click *RegisteredOrganization* and enter your company name.

You can use this technique in Windows NT 3.5's Registry too, but you can't search for *RegisteredOwner* directly. Launch the Registry Editor, choose the *HKEY_LOCAL_MACHINE* window, and expand these outline nodes in turn: *SOFTWARE*, *Microsoft*, *Windows NT*, *CurrentVersion*. Find *RegisteredOwner* and *RegisteredOrganization* in the data pane and double-click them to update the data.

Move Windows 3.1.GRP Files into Windows 95

Like many others, I installed Windows 95 in a new subdirectory, even though the installation program noted that Windows 95 would not find and install my existing Windows 3.1 applications. Sure enough, Windows 95 did not show them on the Start menu. After creating

shortcuts for several, I stumbled upon a way to tell Windows 95 to load the Windows 3.1 applications, organized by their Windows 3.1 groups.

First, copy all *.GRP files from your Windows 3.1 subdirectory (normally \WINDOWS) to the Windows 95 subdirectory (of course, they were backed up before installing Windows 95, right?). The MS-DOS prompt is good for this.

Then, open *Explorer* and select *Tools | Find*. Choose *Files or Folders* and type in the string *.GRP to list all the group files in your Windows 95 subdirectory. Take note of which files are actually Windows 95 versions and which are Windows 3.1. Double-click on each Windows 3.1 version and a window will pop up processing each application in the Windows 3.1 group into the Windows 95 Start menu. Then click on the Start button to confirm the conversion. You can now use the Start button instead of cluttering up your Desktop with shortcut icons.

Some applications that liberally sprinkle their files throughout your hard disk (*WordPerfect* for Windows 6.1 and *Ami Pro 3.1* come to mind) may still need to be reinstalled. Also, users may want to perform some editing of the Start menu to organize everything as it should be. But, this method will work for most applications.

JOSEPH BURNSIDE, Alexandria, Virginia

PC MAGAZINE: Certainly the cautious user will run Windows 95 alongside Windows 3.1—at least at first. What if an essential business application refused to work under Windows 95? But as Mr. Burnside notes, by doing this you forgo the automatic migration of your Windows 3.1 .GRP files. Fortunately, Windows 95's default behavior on opening a .GRP file is to migrate the file's contents into the Start menu's Programs submenu.

The migration process can be even simpler than what's described above. Just select *Find* from the Start menu and seek all *.GRP files in your Windows 3.1 directory. Click on the first file and Shift-click on the last to select them all. Now right-click and select *Open* from the menu that appears. Windows 95 will convert all your old .GRP files in one fell swoop. Select *Programs* from the Start menu and you'll see that they're all present.

There's one more refinement to make menu navigation easier. Right-click on the Start button itself and choose *Explore*. You'll see the contents of the Start menu in the form of folders (for submenus) and files (for menu items). Double-click on *Programs*, choose *New Folder* from the File menu, and name the new folder "Windows 3.1". Now drag each of the folders that were created from a Windows 3.1 .GRP file onto this new folder. Close the *Explorer* and bring up the Start menu again. You'll find that your Windows 3.1 groups now appear as submenus below the Windows 3.1 menu item.



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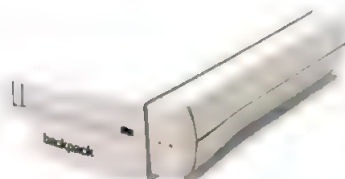
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HARDWARE

Unmasking Your Monitor



In the Solutions column of June 27, 1995, you described a way to measure the dot pitch of a monitor, so I decided to check my own monitor, a ViewSonic 5+. As you suggested, I set Windows to display an all-white screen, but when I focused on the screen using a 4-power loupe, all I saw were solid vertical lines of red, green, and blue. Increasing the magnification to a 10-power loupe only made the vertical lines sharper. I couldn't find the separate triads of phosphors you described. Can you explain why?

FRANK HEARTH, Redlands, California

PC MAGAZINE: My answer was correct as far as it went, but I failed to point out that this technique does not work for all monitors. The fact is that not all monitors have their phosphors arranged in triads of dots.

In the previous column, the reader wondered whether he could confirm that his mon-

itor had a 0.28-mm dot pitch as advertised. By citing the dot-pitch specification, he indicated that his monitor used a standard shadow mask and phosphors arranged in triads of dots.

Other kinds of picture tubes use other kinds of masks, however. One of the most familiar is the Trinitron tube developed by Sony and used by many monitor manufacturers. (Mitsubishi has developed a similar Diamondtron tube.) Instead of a mask with round dots, these tubes use a mask consisting of many fine vertical slits, which is why such designs are sometimes called "slot masks." The three electron guns are arranged in a straight (horizontal) line, so the phosphors are arranged in vertical lines on the inside of the screen's glass.

One giveaway that a monitor uses a slot mask is that no dot-pitch specification is listed. Instead you'll find a "stripe pitch" measurement, which refers to the distance between stripes of the same color. To verify the specification on your monitor using the technique described in the earlier item, turn the ruler so that it is horizontal; you should then be able to measure the pitch for yourself.

—Alfred Poor

Disk Dilemmas

I have a quad-speed ATAPI CD-ROM drive attached to my IDE controller as the slave to a 1GB hard disk. Is it true that having the CD-ROM attached can slow down hard disk performance? I can't access the CD-ROM if I have 32-bit disk access enabled under Windows, but I'd like to be able to use 32-bit access for my hard disk. Is there some way I can do this? And by the way, can you tell me what ATAPI means?

JEFF GOLDSTEIN, via ZD Net

PC MAGAZINE: Let's start with the easiest question first. ATAPI, which stands for *AT attachment packet interface*, is a standard that was developed to allow CD-ROM drives with IDE interfaces to be controlled using the same commands that control SCSI drives.

CD-ROM drives are not compatible with the Western Digital hard disk specification that is required for 32-bit disk access under Windows. As a result, you can't use 32-bit disk access with the CD-ROM drive installed on the same IDE interface as your hard disk. And, unfortunately, this does mean that you may not be obtaining maximum performance from your hard disk.

The solution is to get either an EIDE con-

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- Multimedia docking station with PC bus system accessories (priced separately)
- Built-in 16-bit sound microphone
- 2 speakers & MIDI
- HLC 1.1GB hard drives

WIN95
INSTALLED



Tegra 700

Processor	Screen	Hard Drive	Price
Pentium 120	11.3" Dual Scan	1.1GB	\$4679
Pentium 120	11.3" Active	1.1GB	\$5949



Satellite 2110/2130

Satellite 2110/2130

486DX4/75	10.4" Dual Scan	330MB	\$1679
486DX4/75	10.4" Dual Scan	500MB	1969
486DX4/75	10.4" Active	500MB	2499



Satellite Pro 410

WIN95
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Satellite Pro 400 & Satellite Pro 410

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Satellite Pro 400

Pentium 75	10.4" Dual Scan	772MB	\$2899
Pentium 75	10.4" Active	772MB	3999

Satellite Pro 410

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486DX4/75	10.4" Active	540MB	2599
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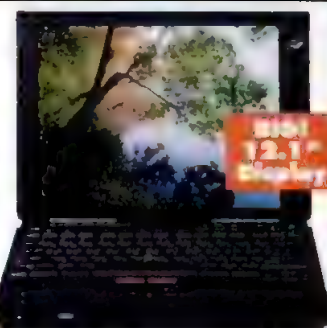


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*Features built-in CD-ROM drive
WIN 95 models available. Call for details.



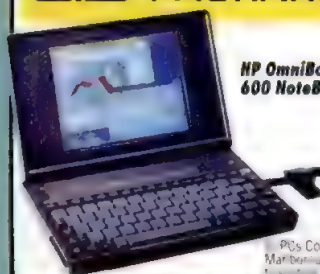
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Minitower	Pentium 100	1GB	2099
Minitower	Pentium 100	1.6GB	2499*
Minitower	Pentium 120	1.6GB	2799*
Minitower	Pentium 133	1.6GB	2999*

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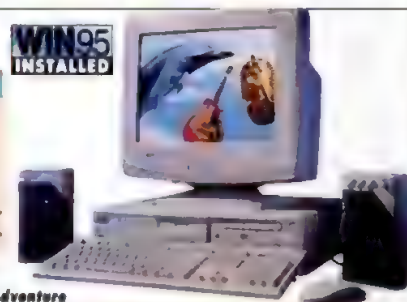
Classic	Processor	MB	Price
Desktop	Pentium 75	81450*	
Desktop	Pentium 100	1.2GB	1750
Desktop	Pentium 133	1.2GB	1950
Minitower	Pentium 100	1.2GB	1950
Minitower	Pentium 133	1.6GB	2330
Minitower	Pentium 150	2.1GB	2920**
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Minitower (933)	Pentium 120	1.6GB	2699*
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Classic	Processor	MB	Price
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Minitower	Pentium 133	1.6GB	2899*

*16MB RAM standard
Monitors priced separately

Intel
inside



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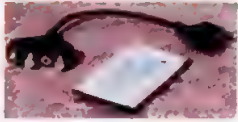
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CC3288	28.8/14.4 PCMCIA	299.99
XJ3288	28.8/14.4 Cellular Modem	325.00
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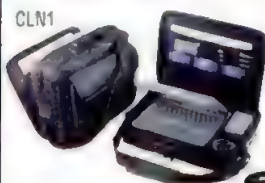
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troller with two IDE channels or a secondary EIDE controller that can add a second channel to go along with your existing controller. Attach your CD-ROM drive to the secondary channel (and reconfigure it as a master instead of a slave drive) and you should be able to regain 32-bit disk access for your hard disk.—*Alfred Poor*

OPERATING ENVIRONMENTS

Sharing a DLL Among Several Programs



Many of the programs I use require the file VBRUN300.DLL. If I copy this file to each directory where these programs are stored, I'd lose a lot of disk space. Is there a way I can keep just a single copy of VBRUN300.DLL and make it available to all the programs that need it?

YU YANG, via ZD Net

PC MAGAZINE: Microsoft's whole purpose in putting most of the runtime code for Visual Basic programs into VBRUN300.DLL was to save disk space, not to make you expend it unnecessarily. You shouldn't need more than one copy, and the normal place for it is the Windows System directory (usually C:\WINDOWS\SYSTEM). For safety's sake, though, don't just delete duplicates residing in other locations. Instead, rename them, perhaps changing the extension to .RID. Run all your programs that rely on VBRUN300.DLL and

make sure they work correctly. Then you can get rid of the .RID files.

This should hold true for any shared files—you need only one copy, which should exist in the Windows System directory. But in real life, this isn't always possible. For example, two programs may use different versions of the same DLL that aren't completely compatible, or a program may be badly written and require the DLL to be in the same directory as the program itself. That's why you can't blindly delete the duplicates; you have to hide them first by changing their names and then check to make sure all the programs still work.

—*Neil J. Rubenking*

Preventing Breakout During Boot-up

In my high school library we have two computers that students can use for research by inserting various CD-ROMs. But some students like to get into DOS and play around with the files—they can do this by simply entering Ctrl-C when the computer boots up. We're running DOS 5.0 and Microsoft Windows. Is there any way to prevent people from intruding where they don't belong?

DAVID GRANDA, via the Internet

PC MAGAZINE: Neither DOS nor Windows includes the security features you'd need to completely protect your system from malicious mischief. If your students really want to mess up the system, chances are good they'll

be able to do so. But you can put enough obstacles in their way so that most of them won't bother.

The first thing to do is to disable the keyboard during the processing of CONFIG.SYS and AUTOEXEC.BAT. Figure 1 shows a DEBUG script that produces KDISABLE.SYS, a nonresident device driver that simply disables access to the keyboard. Redirect the script into DEBUG with the following command:

```
DEBUG < KDISABLE.SCR > KDISABLE.LOG
```

Check the log to make sure there are no ^ Error lines; if there are, fix the offending lines and process the script with DEBUG again. Follow the same procedure with the script in Figure 2; this will generate KENABLE.COM, a program to reenoble the keyboard.

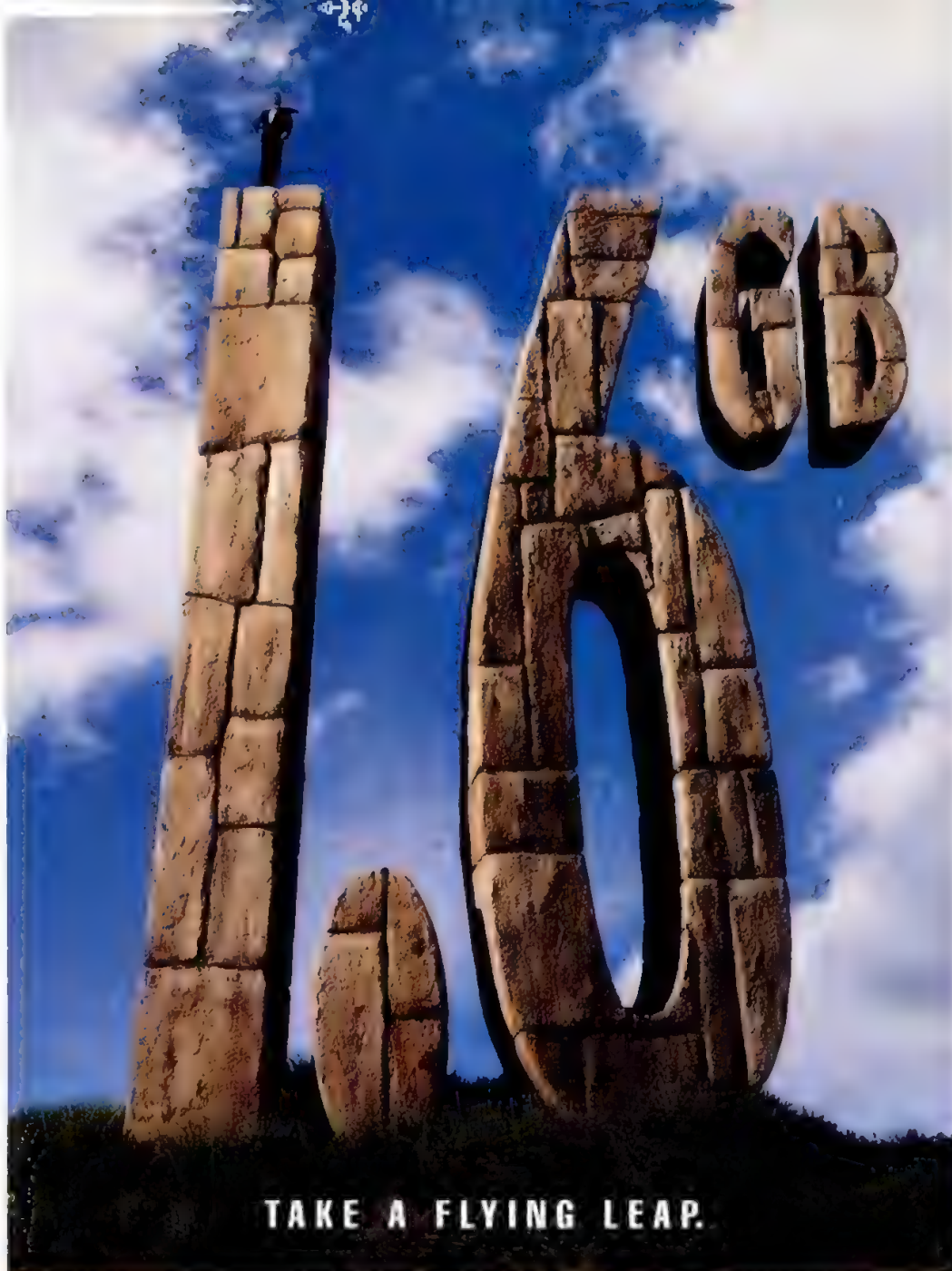
Test these tiny utilities by adding DEVICE=d:\dirname\KDISABLE.SYS as the first line in CONFIG.SYS (replacing d:\dirname with the actual drive and directory containing the file) and running KENABLE.COM as the last line in your AUTOEXEC.BAT. Reboot the computer and try to break out of the boot process by pressing Ctrl-Break or Ctrl-C. You should find that the keyboard is disabled until the end of AUTOEXEC.BAT and reenabled thereafter. If something goes wrong and this doesn't happen, restart the system and, when the "Starting MS-DOS..." message appears, press F5 to skip processing of AUTOEXEC.BAT

```
N KDISABLE.SYS
A 100
: link to next device driver
DW FFFF FFFF
: device attributes
DW 8000
: entry point for strategy routine
DW 0016
: entry point for interrupt routine
DW 0021
: logical device name (blank)
DB ' '
: pointer to request header
DW 0000 0000
:
: Strategy routine
:
CS:          : just store the request header pointer
MOV [0012],BX
CS:
MOV [0014],ES
RETF
:
: Interrupt routine
:
```

```
PUSH DS
PUSH DI
PUSH CS
POP DS
IN AL,21
OR AL,2 ; mask out keyboard interrupt
OUT 21,AL
LES DI,[0012] ; ES:DI points to request header
ES:          ; request status = 0100h (done)
MOV WORD PTR [DI+03],0100
ES:
MOV WORD PTR [DI+0E],0000
ES:
MOV [DI+10],CS ; reserve NO memory
POP DI
POP DS
RETF

RCX
42
W
Q
```

FIGURE 1: This DEBUG script produces a nonresident device driver that disables the keyboard.



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*"As far as I know,
today the better teams
beat the worse ones.
Back to you Vern."*



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and CONFIG.SYS. Double-check your KDISABLE.SCR, re-create the two small utilities, and try again.

Once you've got the system working, you need to prevent your students from doing as you just did and pressing F5 at boot-up. Before you take this next step, format a floppy disk with the /S (for System) switch, then test the disk to be sure you can boot the system from it. Make sure you put this disk in a safe place, because you'll need it when you want to make changes to the system configuration. Now add the line SWITCHES=N to

```
KENABLE.COM
A 100
IN AL,21
AND AL,FD ; un-mask the interrupt
OUT 21,AL
RET

RCX
7
W
Q
```

FIGURE 2: Use the tiny program that this script produces to reenable the keyboard.

CONFIG.SYS to disable breaking out of the boot process.

If your system boots directly into Windows, you can move the KENABLE.COM call from AUTOEXEC.BAT to WINSTART.BAT. (When a file by this name exists in the Windows directory, it gets executed when Windows starts up.) That way your students will be unable to bypass Windows. Remove the program items for WINFILE.EXE and any other Windows programs that allow manipulation of the file and directory structure of the disk, then add these lines to PROGMAN.INI:

```
[Restrictions]
NoFileMenu=1
NoSaveSettings=1
EditLevel=4
```

These settings completely remove the File menu from Program Manager and will prevent users from making any changes to the program groups. Use the DOS program ATTRIB to make PROGMAN.INI read-only, then remove the MS-DOS prompt icon from the Main group so the read-only attribute can't be removed.

Reboot your system when you've completed these changes. Now the only simple way for your students to do mischief to the system would be to boot from a floppy disk; a physical lock on the floppy disk drive can close that avenue. Your system won't be safe from a dedicated hacker, but the average student won't be able to stray from approved activities.—Neil J. Rubenking

WORD PROCESSING

The Winword.concept Virus



As you may have already heard, there's a virus floating around that attaches itself to Microsoft Word for Windows documents and will infect every document you save with the Save As command. This Winword.concept virus—called the Word prank macro by Microsoft—represents a newly prevalent class of virus. And although this particular virus happens to be aimed at Word for Windows, it's something that even non-Word users should know about. Any program with a sufficiently sophisticated macro language is open to attack by similar viruses.

While viruses have traditionally attached themselves to program files or boot records, this type of virus attaches itself to data files created by applications that associate macros with data files. That's what makes it so pernicious. The virus can infect any Word-format file saved by Word 6, Word 95, Mac Word 6, and Word NT.

You can protect yourself from traditional viruses by simply not booting from floppy disks and not running new programs until you check them for viruses. But if you often exchange document files with others, particularly in a busy workgroup where documents regularly travel among many people, contamination may be difficult to avoid.

An infected document is actually a template masquerading as a document. The virus can manage this trick because although Word uses a .DOT extension by default for templates, it doesn't require that .DOT extension. And a template, by any name, can store macros. The key to the Winword.concept virus is an AutoOpen macro, which runs each time you open the document. When you open an infected document, the virus modifies the Normal template, Normal.dot, which Word keeps loaded at all times—even when you're using another template. Once infected, Normal.dot will infect any file you save with the Save As command. And since WinWord calls on the Save As command every time you save a new document, that means every new document you create will be infected.

The good news about the Winword.concept virus is that, in its original form at least, it's only annoying, not harmful. (The virus contains the comment "That's enough to prove my point." Obviously the anonymous author wanted to show that a virus could be transmitted via a macro, but didn't feel the need to be destructive about it.) The bad news is that the virus was unleashed on the world in unencrypted form. That means

anyone who gets ahold of it and understands just a little Word Basic can modify it to do serious harm—like erasing files from your hard disk. (I won't get more specific for obvious reasons.)

Fortunately, the virus is easy to spot. And it's easy to prevent, too, once you know to look out for it. The first thing to do is to make sure you're not infected yet. Load WinWord, choose Tools | Macro, and set the Macros Available In box to Normal.dot (Global Template). Then browse through the list of macros, looking for the names AAAZAO or AAAZFS. These are the virus's macros. If you see them, don't create any new files or use your Save As command until you've decontaminated your system.

Microsoft has developed a set of tools for eliminating the Winword.concept virus and inoculating your copy of WinWord against it. You can find the tools on Microsoft's World-Wide Web site at <http://www.microsoft.com/msoffice>, on the Microsoft Network using the go word "wordprankfix," and on the Word forums on America Online and CompuServe. You can also call Microsoft product support at 206-462-9673.

You'll find the tools—three macros—in a WinWord file generically called SCAN.DOC. (The file is actually named SCAN831.DOC as of this writing; 831 is a version number.) One macro, CleanAll, runs when you open SCAN.DOC, scanning a specific directory and all subdirectories. CleanAll looks for all documents and templates saved since January 1, 1995; it opens them and checks for the virus macros, then cleans these out if it finds any.

SCAN.DOC installs the other two macros in your Normal template. AutoClose scans all documents when you save them, cleaning out any virus macros it finds. Payload prevents the virus from installing in your Normal template in the first place. (The virus needs to create a macro called Payload when it installs. If there's already a Payload macro there, the infection fails.)

If you aren't infected, you can create your own Payload macro to guard against the virus. Simply choose Tools | Macro to open the Macro dialog box and set the Macros Available In box to Normal.dot. Then enter Payload as the name of the macro and choose Create. WinWord will open a macro-editing window, with Sub Main and End Sub statements already in place. Add a space on the blank line between the two statements or perhaps a comment like "Protection against Winword.Concept virus; do not delete." (If you don't add something, WinWord will close the window without saving the macro.) Select File | Close and answer Yes when WinWord asks whether to save the macro, then choose File | Save All to save the new macro to disk.

Once you've installed the Payload macro in

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your Normal template, you're safe from the Winword.concept virus, but don't get overconfident. You're not protected from viruses that work on the same principle but change the details. A more general defense is to prevent an AutoOpen macro from running on a document unless you're absolutely sure it is virus-free. The easy way to do this is to hold down the Shift key when you open the document (that is, hold down the Shift key as you click OK in the File | Open dialog box). Lotus Notes users should also hold the Shift key down when using the Launch command to open a WinWord document attached to a Notes message.

If you use Word 95 with Windows 95 and you've set up Word to act as your Exchange mail program using WordMail, be assured that you can't get infected by reading a message. But you can get infected by double-clicking on an attached Word file to open it and read it. Here again, hold the Shift key down when you double-click on the icon.

Alas, these precautions will guard only against viruses that depend on an AutoOpen macro to spread. They still leave you vulnerable to a virus that waits until after you've opened the infected file and waits for, say, your first keystroke. The only way around that problem is to avoid opening any files that are supposed to be documents but are actually templates with macros.

By the time you read this, Microsoft should have released a new Macro Virus Protection Tool to accompany SCAN.DOC. The tool—a macro—will warn you when a document you're about to load is actually a template with macros and will let you choose whether to load it. While this can protect you from accidentally loading a file that may contain macro viruses, you can't actually open the file to see the text inside. Luckily, there's a quick, easy workaround that uses the Organizer.

To see a list of macros in a file, choose File | Template, then Organizer. Click the Close File button on either the left or right side of the Organizer dialog box and the button will become an Open File button. Click that button and use the Open dialog box to find and open the file you want to inspect.

Now choose the Macros tab to see a list of the macros in the file. If the file purports to be a simple data file—rather than a template—it shouldn't contain any macros. If you see any, you can delete them and then safely open the file.

One note of caution: Some third-party packages use templates to ease installation of their macros. So the fact that a file masquerades as a document when it's really a template doesn't necessarily mean it has a virus. Before you start deleting macros, make sure they really shouldn't be there. —M. David Stone

SPREADSHEETS

Evaluating Text in Lookup Tables



I'm trying to calculate grade-point averages from information recorded in an Excel table similar to the following:

	Aaron	Barbara	Carl
English	D	A-	C
Chemistry	D-	D	C-
Algebra	A-	A-	A+
History	F	F	F
French	B	D	A

I've created a grade-point lookup table that looks like this:

A+	4.3333
A	4
A-	3.6667
B+	3.3333
B	3
B-	2.6667
C+	2.3333
C	2
C-	1.6667
D+	1.3333
D	1
D-	0.6667
F	0

But when I use VLOOKUP to reference this table, I consistently get the wrong results. For example, if Aaron's D in English is stored in cell B2 and the lookup table is named Grade_Table, then the formula

`=VLOOKUP(B2,Grade_Table,2)`

returns 1.667, instead of 1. What am I doing wrong?

Second question: Once I've got my lookup table working correctly, can I use an array formula to calculate the GPA in a single cell, or do I have to set up a column of individual grade scores and then take the average of that column?

LEONARD PRESBERG, Richmond, Virginia

PC MAGAZINE: Your lookup function will work fine if you just add one more argument—the word FALSE. For example, the formula

`=VLOOKUP(B2,Grade_Table,2,FALSE)`

correctly returns 1 as the score for Aaron's D in English.

The FALSE argument tells Excel's VLOOKUP function to scan the first column of the lookup table for exact matches. If no match is found, the function returns N/A.

If you omit VLOOKUP's fourth argument (or explicitly enter TRUE, the default value for this argument), VLOOKUP assumes that you don't care about finding exact matches. In that case, it scans downward through the first column of your lookup table until it finds either your lookup value (the grade you want to score) or a value greater than your lookup value. If it finds a value greater than your lookup value, it stops and returns a value from the row above.

In your table, for example, D+ appears above D. When you ask VLOOKUP to scan the first column of the table for the value D, the function finds D+ before it ever gets to D. Because D+ is a value greater than D (to the computer's peculiar way of thinking), VLOOKUP concludes that it has gone too far, so it returns a grade-point score from the C-row.

Your VLOOKUP formulas will work fine without the FALSE argument if you sort your lookup table so that its first column is in strict alphabetical order, like this:

A	4
A-	3.6667
A+	4.3333
B	3
B-	2.6667
B+	3.3333
C	2
C-	1.6667
C+	2.3333
D	1
D-	0.6667
D+	1.3333
F	0

But it's smarter to add the argument and force the function to find exact matches. That way you can keep the table in the order that makes sense to you, and if you inadvertently enter a grade that's not in the table (C++, for example), Excel alerts you by returning N/A.

In Lotus 1-2-3 and Quattro Pro, the situation is different. These programs assume that if the first column in your vertical lookup table contains text, you're interested only in exact matches. Therefore, you don't have to sort your lookup values in Lotus 1-2-3 or Quattro Pro. (If you try to look up a value that's not in the table, the function returns ERR.)

As for your second question, the following Excel array formula looks like it should give you a GPA for the grades recorded in cells B2:B6:

`{=AVERAGE(VLOOKUP(B2:B6,Grade_Table,2,FALSE))}`

But, alas, it does not. I recommend a user-defined function instead. Use the Insert Macro Module command and type the following

Insight

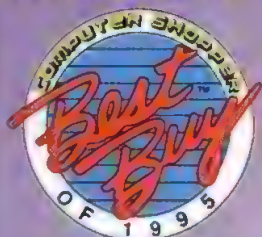
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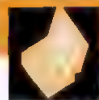
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Satellite Pro 410	Pentium 90	11.3" Active	8MB/772MB	TA410CDT7	4,599
Satellite Pro 410	Pentium 90	11.3" Dual Scan	8MB/772MB	TA410CS7	3,419
Tecra 700	Pentium 120	11.3" Active	16MB/1.13GB	TA700CT	5,799
Tecra 700	Pentium 120	11.3" Dual Scan	8MB/1.13GB	TA700CS	4,589

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SCSI Hard Drives

Capacity**	Access	Form/Height	Interface	Cache	RPM	Model	Bare Kit	16 Bit Kit
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1050MB	9ms	3.5" 1"H	Fast SCSI-2 A/V	512	5,411	ST31231N	\$375	\$475
1080MB	10.5ms	3.5" .75"H	Fast SCSI-2 A/V	128	5,400	ST51080N	269	369
2147MB	9ms	3.5" 1"H	Fast SCSI-2 A/V	512	5,411	ST32430N	699	799
4294MB	9ms	3.5" HH	Fast SCSI-2 A/V	512	5,411	ST15230N	959	1,059
9090MB	11ms	5.25" FH	Fast SCSI-2 A/V	1,024	5,400	ST410800N	2,129	2,229
High Performance Barracuda Drives								
2147MB	8ms	3.5" 1"H	Fast SCSI-2 A/V	512	7,200	ST32550N	\$759	\$859
4294MB	8ms	3.5" HH	Fast SCSI-2 A/V	1,024	7,200	ST15150N	1,139	1,239

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Fujitsu

540MB	10ms	3.5" 1"H	Fast SCSI-2 A/V	256	5,400	FJ1603S	\$190	\$290
1080MB	10ms	3.5" 1"H	Fast SCSI-2 A/V	256	5,400	FJ1606S	259	359
2100MB	8.9ms	3.5" HH	Fast SCSI-2 A/V	512	7,200	FJ2915S	659	759
4200MB	8.9ms	3.5" HH	Fast SCSI-2 A/V	512	7,200	FJ2934S	959	1,059
68 Pin Wide SCSI Drives								
2100MB	8.9ms	3.5" HH	Wide Fast SCSI-2 A/V	512	7,200	FJ2915W	\$659	\$759
4200MB	8.9ms	3.5" HH	Wide Fast SCSI-2 A/V	512	7,200	FJ2934W	959	1,059

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9100MB	12ms	5.25" FH	Fast SCSI-2 A/V	512	5,400	MC1991AV	2,139	2,239

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2100MB	8.5ms	3.5" 1"H	Wide Fast SCSI-2 A/V	512	7,200	MC4221AVW	\$949	\$1,099
4300MB	8.5ms	3.5" HH	Wide Fast SCSI-2 A/V	512	7,200	MC3243AVW	1,249	1,399
9100MB	12ms	5.25" FH	Wide Fast SCSI-2 A/V	512	5,400	MC1991AVW	2,229	2,379

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1080MB	12ms	3.5" 1"H	Fast SCSI-2	128	5,400	QUFB1080S	299	399
2216MB	8.5ms	3.5" 1"H	Fast SCSI-2	512	5,400	QUVP3221S	699	799
2150MB	8ms	3.5" 1"H	Fast SCSI-2	1,024	7,200	QUXP3125S	799	899
4280MB	8.5ms	3.5" HH	Fast SCSI-2	512	7,200	QUGP4280S	1,049	1,149

Conner

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2147MB	8.5ms	3.5" 1"H	Fast SCSI-2	512	5,400	CFP2105S	699	799
2147MB	8.5ms	3.5" 1"H	Fast SCSI-2	512	7,200	CFP2107S	799	899
4294MB	9ms	3.5" HH	Fast SCSI-2	512	7,200	CFP4207S	1,079	1,179

IBM

68 Pin Wide SCSI Drives

2100MB	7.5ms	3.5" 1"H	Wide Fast SCSI-2	512	7,200	IB94G3055	\$1,219	\$1,369
4500MB	8ms	3.5" HH	Wide Fast SCSI-2	512	7,200	IB94G3057	1,699	1,849
5310MB	8ms	3.5" HH	Wide Fast SCSI-2	512	5,400	IB94G3059	1,499	1,649

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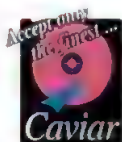
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IDE Hard Drives

Capacity**	Access	Form/Height	Interface	Cache	RPM	Model	Bare Kit	16 Bit Kit
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1080MB	10ms	3.5" 1"H	Enhanced IDE	128	5,200	WD21000A	229	279*
1280MB	10ms	3.5" 1"H	Enhanced IDE	64	4,500	WD31200A	269	319*
1280MB	10ms	3.5" 1"H	Enhanced IDE	128	5,200	WD21200A	NEW! Call for pricing	319*
1620MB	10ms	3.5" 1"H	Enhanced IDE	128	5,200	WD31600A	339	389*

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630MB	14ms	3.5" 1"H	Fast-ATA	120	3,811	ST3630A	179	229*
722MB	12ms	3.5" 1"H	Fast-ATA-2	256	4,500	ST3780A	179	229*
854MB	11ms	3.5" .75"H	Fast-ATA-2	256	5,400	ST5850A	209	259*
1270MB	12ms	3.5" 1"H	Fast-ATA-2	256	4,500	ST31270A	259	309*
2167MB	10.5ms	3.5" 1"H	Fast-ATA-2	256	5,400	ST32140A	479	529*

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Quantum

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1080MB	12ms	3.5" 1"H	Fast-ATA-2	128	5,400	QUFB1080A	235	285*
1280MB	12ms	3.5" 1"H	Fast-ATA-2	128	5,400	QUFB1280A	259	309*

Maxtor

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1260MB	12ms	3.5" 1"H	Enhanced IDE	256	4,500	MX71260AV	260	310*
1620MB	11ms	3.5" 1"H	Enhanced IDE	256	4,500	MX71626A	349	399*

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635MB	14ms	3.5" 1"H	Enhanced IDE	32	3,600	CFS635A	\$185	\$235*
850MB	14ms	3.5" 1"H	Enhanced IDE	32	3,600	CFS850A	199	249*
1275MB	14ms	3.5" 1"H	Enhanced IDE	32	3,600	CFS1275A	259	309*

IBM

540MB	12ms	3.5" 1"H	Fast-ATA	256	4,500	IB06H7141	\$185	\$205*
1080MB	10.5ms	3.5" 1"H	Fast-ATA	512	5,400	IB94G3186	269	319*

*Bundled with GSI Model 21 EIDE Accelerator. **Capacities based upon manufacturer's quoted capacity where 1MB = 1,048,756 bytes.

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CIRCLE 219 ON READER SERVICE CARD

onto the new module sheet:

```
Function GPA(Grades)
    For Each Item In Grades
        Score =
        ➔Application.VLookup(Item.Value, _
        ➔Range("grade_table"), 2, False)
        GPT = GPT + Score
    Next Item
    GPA = GPT / Grades.Count
End Function
```

With this code in place, type

=GPA(B2:B6)

This will get you the grade-point average for the grades in cells B2:B6.—*Craig Stinson*

DATABASES

Opening Microsoft Access Objects in Design View



Here is an undocumented way to open an Access object in design view from the Database container window. Just hold down the Ctrl key and double-click the object you want to open. This trick works with tables, queries, forms, reports, macros, and modules. You can use this technique in Access 1.x, Access 2.x, and Access 95.

In Access 1 you can also reach the design view for any of the above objects by double-clicking the right mouse button. In Access 2 and Access 95, the right mouse button brings up a shortcut menu, so the right mouse double-click technique has been deactivated.

SHANE DEVENSHIRE,
Walnut Creek, California

PC MAGAZINE: I always find secret keyboard techniques like this useful. Note that you can also open an object in design view by selecting it and pressing Ctrl-Enter or Alt-D, or by right-clicking the object and then choosing Design from the context menu.—*Sal Ricciardi*

Active Clock and Date Forms in Microsoft Access

Here's a way to add the date and time to the caption of any form in Microsoft Access. This adds an active clock that updates the seconds as they go by. If you leave your computer on, the date will change at midnight as well.

To try this technique, start by opening a form in design view. Next, double-click on the Form Selector box just to the left of the ruler to bring

up *Form Properties*. Make sure you have *Form Properties* and not *Section Properties*. If you have difficulty, select the *Edit* menu and choose *Select Form*. Then select the *View* menu and choose *Properties*.

Next, choose the *All* tab and scroll down to the bottom of the list. Then select the *Timer Interval* property and type in 1000. This tells Access to update the date and time on your form every 1,000 milliseconds, or 1 second.

Immediately above *Timer Interval* is the *On Timer* event. Click once in the *On Timer* text box, then choose the ... button to open the *Choose Builder* dialog. Next choose the *Code Builder* and add the following line at the insertion point:

```
Me.Caption = Format(Now, "c")
```

The "Me." is a shortcut that means the current form.

That's it! Now close the *Code Builder* and the *Properties* window and run the form. You'll see today's date and the current time in the caption of the form.

You can use the *Format* statement to display the time and date in different ways. For example, you could remove the seconds or add the day of the week. If you choose not to display the seconds, you'll want to change the *Timer Interval* to 60000. That way the time will be updated only once a minute (once every 60,000 milliseconds, or once every 60 seconds).

You can also place the time inside the form as a *Label* properties caption or on other objects. If you want to include the name of your form in the caption along with the time and date, you'll need to change the line above to

```
Me.Caption="Form name here" +
➔Format(NOW, "c")
```

Substitute your form name in place of "Form name here."

ROB MCCORMACK,
Thunder Bay, Ontario, Canada

PC MAGAZINE: You can think of this as an opportunity to make something happen once every *Timer Interval*. In this example you update a date and time display on the caption of a form every 1,000 milliseconds.

Windows sends *Timer* event messages to your form at regular intervals. You specify how often in the form's *Timer Interval* property. Remember that the value you supply is in milliseconds, so 1000 equals 1 second, 60000 equals 60 seconds, and so on.

Once you specify how often you want the timer event to occur, you can then give Access something to do each time it happens. For example, you can run a macro or an event procedure at each interval. You might find this useful to requery underlying records in a multiuser application, for example.

Clearly it's also useful for displaying the date or time somewhere in your application. You might also use it to maintain some type of visible status indicator ("number of hours left before Friday at 5:00!").

Mr. McCormack uses the *Now* function to return the date and time. You could also use *Date* for just the date or *Time* for just the time. To remove the seconds from the date and time display, try

```
Me.Caption = Format(Now,
➔"m/d/yy hh:mm AM/PM")
```

The active clock doesn't have to reside in the caption. For instance, you could add a dedicated clock control to your form. To do so, add a *Label* named *Clock* to your form and then add the following line to the form's *On Timer* event procedure (Access calls this event procedure *Form_Timer*):

```
Clock.Caption = Format(Time,
➔"hh:mm AM/PM")
```

You'll want to set the *Timer Interval* to 60000. Note, however, that the clock isn't updated when you first open the form until the first time interval expires. When you set the *Timer Interval* to anything more than a second or two, this becomes noticeable. To get around this, you can call the *On Timer* event procedure from your form's *On Open* event procedure, which executes immediately when the form is first opened. Simply add the line

```
Form_Timer
```

to your *On Open* event procedure. That will cause the clock to be updated once as soon as the form is opened. You'll probably also want to set the *Clock* label's *Back Style* and *Border Style* properties to *Transparent*.—*Sal Ricciardi*

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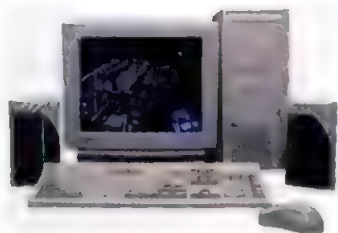
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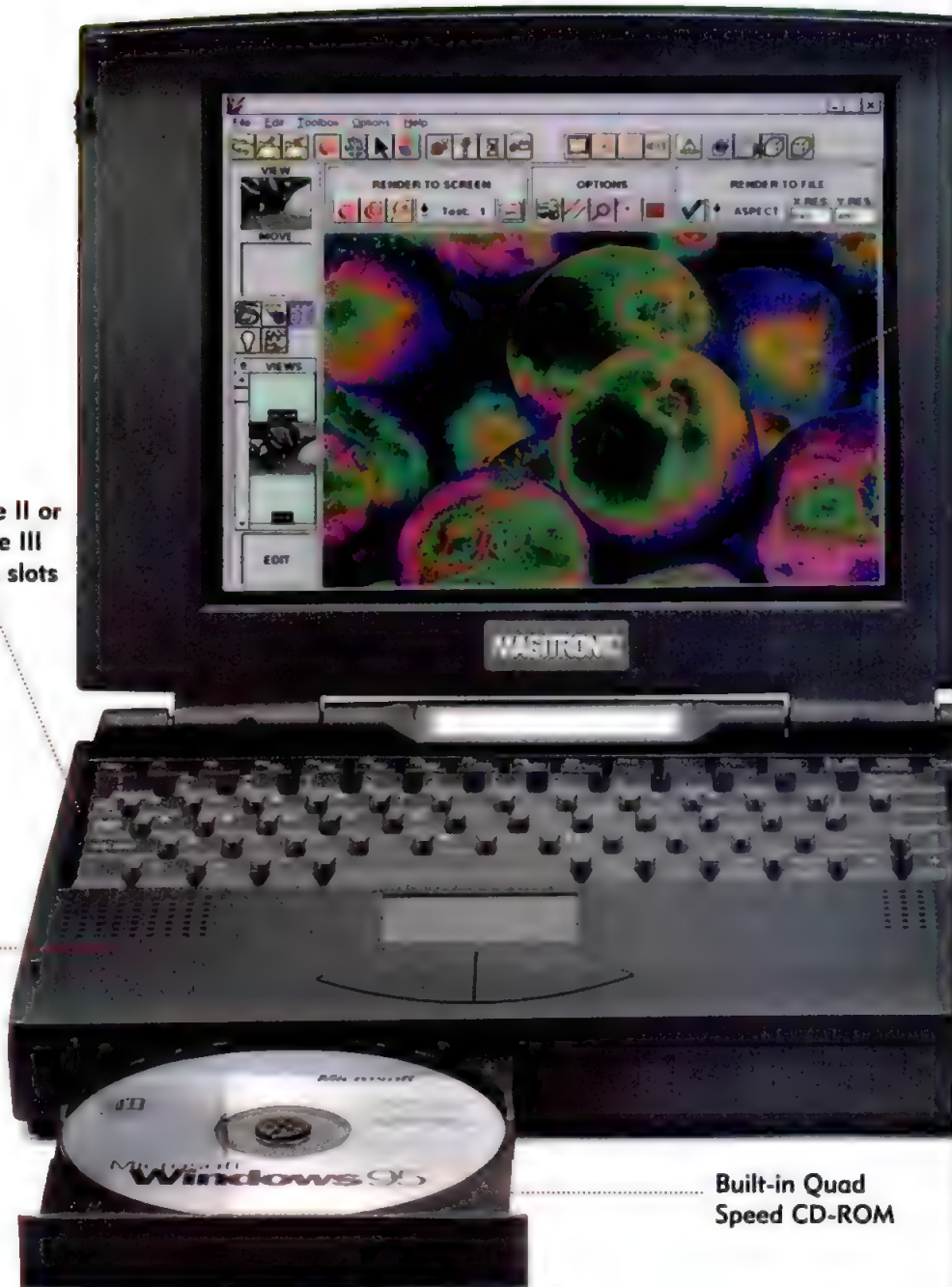


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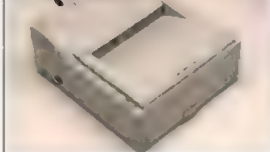
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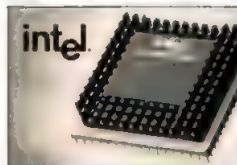
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8MB	14.00	11.00	8.00	7.00
16MB	14.00	11.00	8.00	7.00
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2MB	14.00	11.00	8.00	7.00
4MB	14.00	11.00	8.00	7.00
8MB	14.00	11.00	8.00	7.00
16MB	14.00	11.00	8.00	7.00
32MB	14.00	11.00	8.00	7.00
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128 x 16 1mg	14.00	14.00	14.00	14.00	14.00	14.00	14.00
64 x 16 1mg	14.00	14.00	14.00	14.00	14.00	14.00	14.00
32 x 16 1mg	14.00	14.00	14.00	14.00	14.00	14.00	14.00
256 x 32 1mg	14.00	14.00	14.00	14.00	14.00	14.00	14.00
128 x 32 1mg	14.00	14.00	14.00	14.00	14.00	14.00	14.00
64 x 32 1mg	14.00	14.00	14.00	14.00	14.00	14.00	14.00
32 x 32 1mg	14.00	14.00	14.00	14.00	14.00	14.00	14.00
256 x 64 1mg	14.00	14.00	14.00	14.00	14.00	14.00	14.00
128 x 64 1mg	14.00	14.00	14.00	14.00	14.00	14.00	14.00
64 x 64 1mg	14.00	14.00	14.00	14.00	14.00	14.00	14.00
32 x 64 1mg	14.00	14.00	14.00	14.00	14.00	14.00	14.00

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8450008 (160M)	640.00
8450009 (180M)	720.00
8450010 (200M)	800.00
8450011 (220M)	880.00
8450012 (240M)	960.00
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8450015 (300M)	1200.00
8450016 (320M)	1280.00
8450017 (340M)	1360.00
8450018 (360M)	1440.00
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8450020 (400M)	1600.00
8450021 (420M)	1680.00
8450022 (440M)	1760.00
8450023 (460M)	1840.00
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8450054 (100M)	400.00
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8450095 (120M)	480.00
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8450107 (360M)	1440.00
8450108 (380M)	1520.00
8450109 (400M)	1600.00
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8450111 (440M)	1760.00
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8450113 (480M)	1920.00
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8450144 (100M)	400.00
8450145 (120M)	480.00
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8450147 (160M)	640.00
8450148 (180M)	720.00
8450149 (200M)	800.00
8450150 (220M)	880.00
8450151 (240M)	960.00
8450152 (260M)	1040.00
8450153 (280M)	1120.00
8450154 (300M)	1200.00
8450155 (320M)	1280.00
8450156 (340M)	1360.00
8450157 (360M)	1440.00
8450158 (380M)	1520.00
8450159 (400M)	1600.00
8450160 (420M)	1680.00
8450161 (440M)	1760.00
8450162 (460M)	1840.00
8450163 (480M)	1920.00
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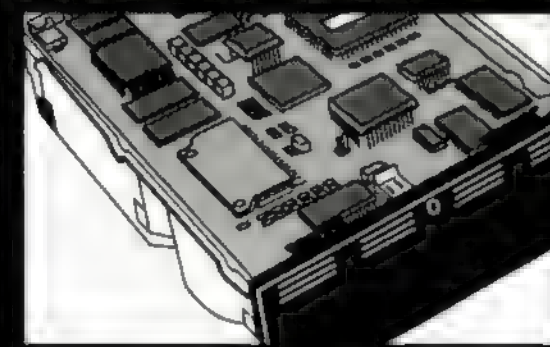
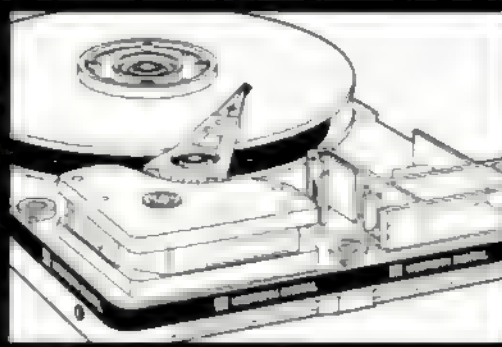
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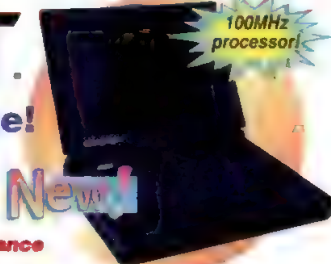
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EXB-8700 6MM	1082.75
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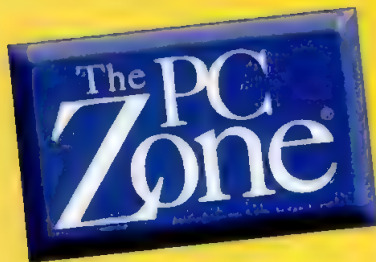
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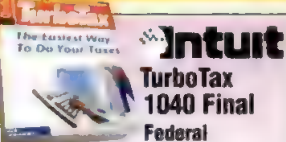
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29912	ThinkPad 350S 14" 28 Color Monitor \$1,799.00
29913	ThinkPad 350S 14" 28 Color Monitor \$1,799.00
29914	ThinkPad 350S 14" 28 Color Monitor \$1,799.00
29915	ThinkPad 350S 14" 28 Color Monitor \$1,799.00
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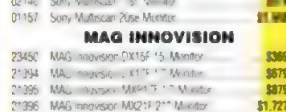
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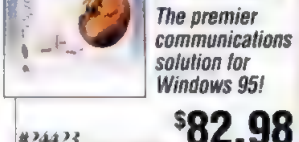
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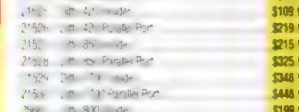
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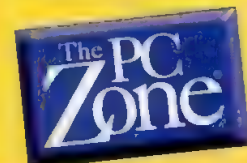
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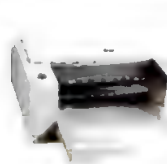
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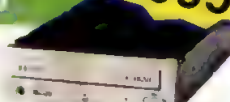


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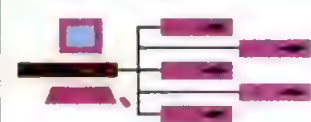


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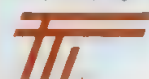
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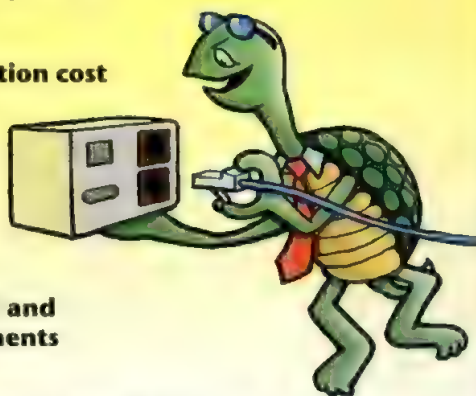
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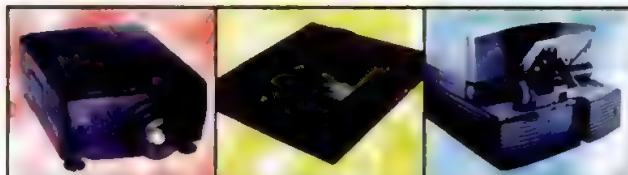
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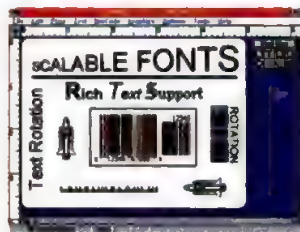
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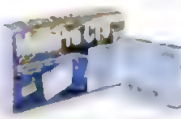
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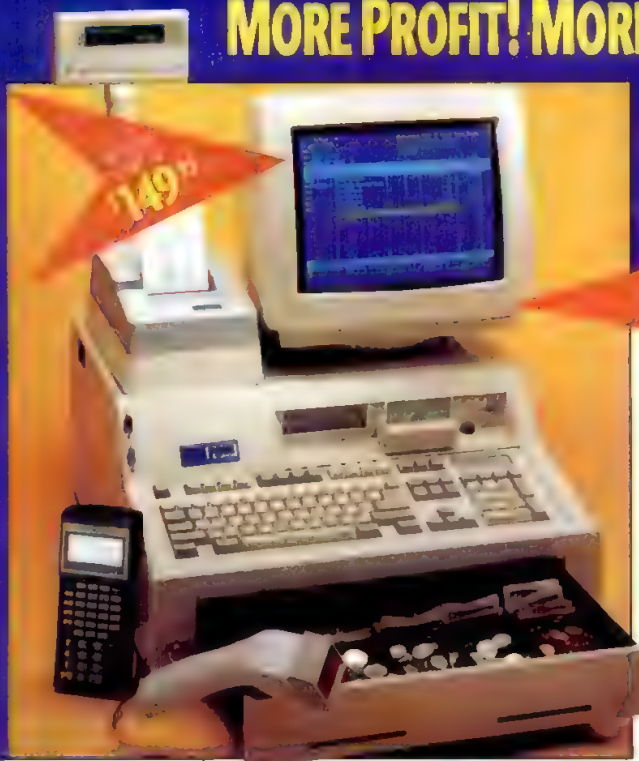
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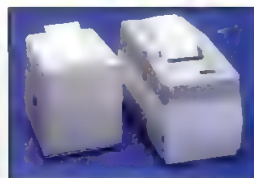
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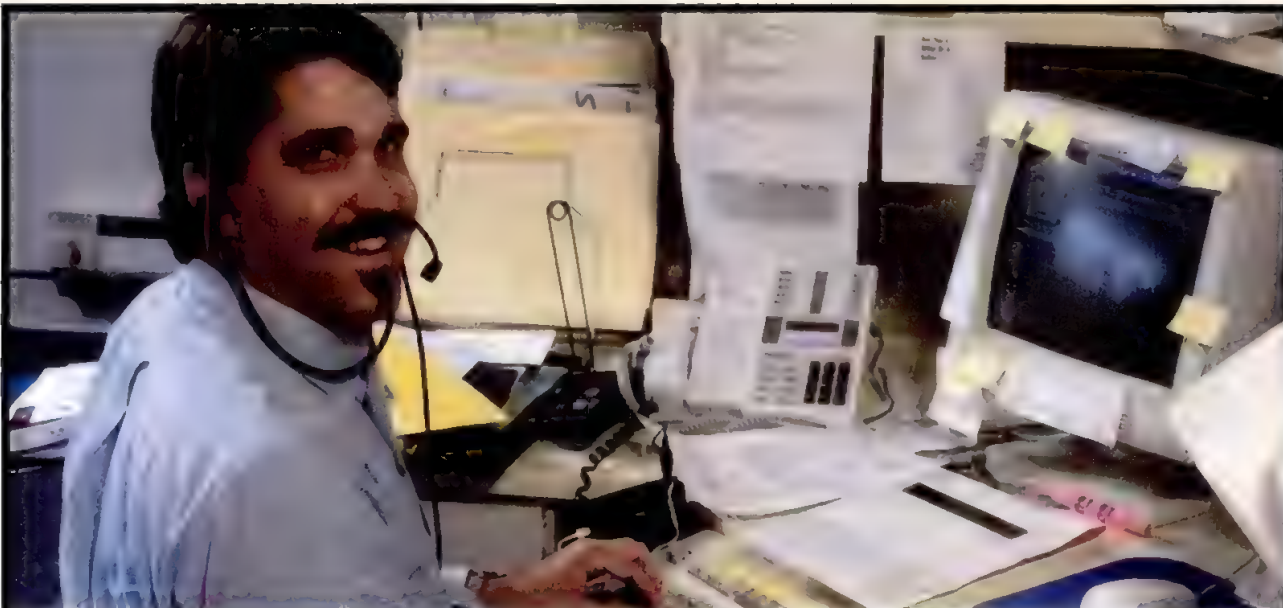
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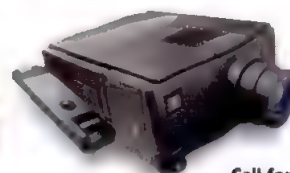
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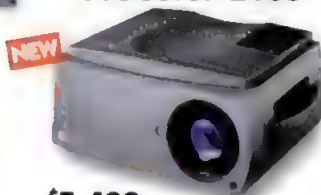
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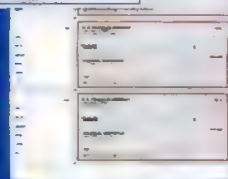
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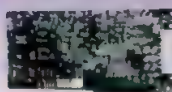


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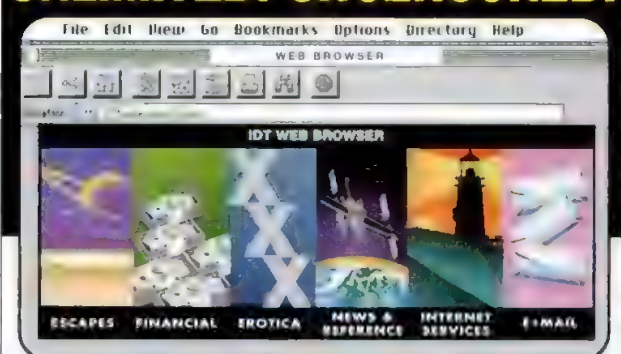
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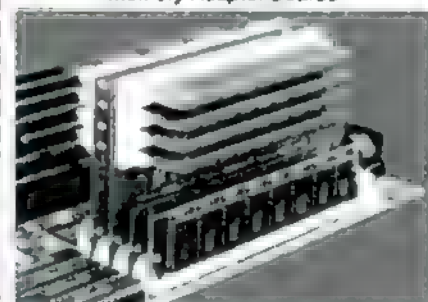
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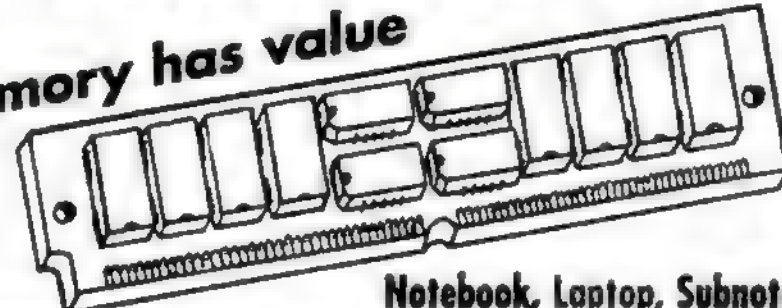
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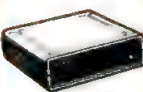
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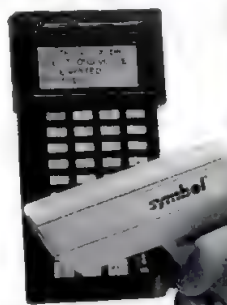
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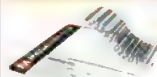
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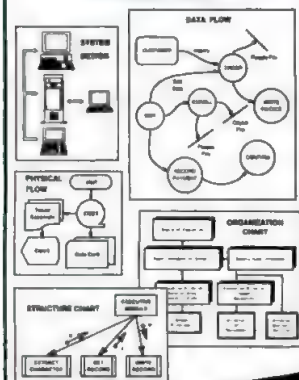
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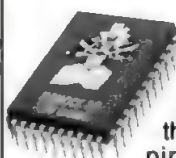
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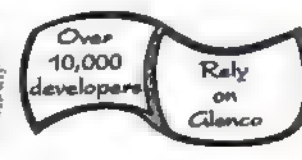
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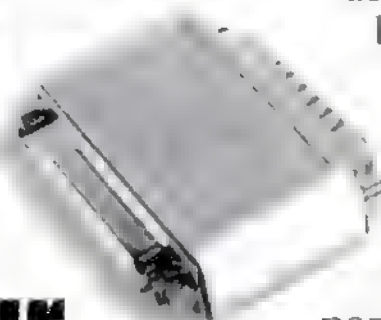
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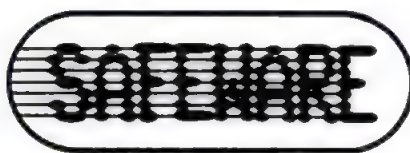
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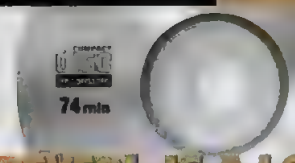
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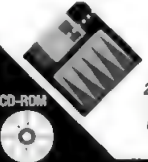
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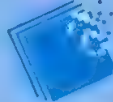
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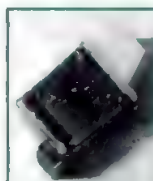
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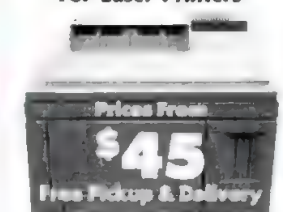
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After Hours

EDITOR'S RATINGS: ★ Poor ★★ Fair ★★★ Good ★★★★ Excellent

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Joysticks: Get a Grip on Your Games

So you just got Wing Commander IV installed, and you're having a little trouble controlling your Ban-shie fighter with the keyboard? Or maybe you've had it with the many key commands necessary to maneuver your ship through the mines in Descent? What you need is a good joystick and you're in luck, because we're looking at four good ones here.

These sticks, which range in price from around \$40 to \$100, come from three of the biggest names in controllers—Thrustmaster, CH Products, and Advanced Gravis—and one relative newcomer: Microsoft.

XL Action Controller

Thrustmaster; 503-639-3200.

Circle 441 on reader service card

★★★ \$39.95

Thrustmaster has garnered quite a loyal following among hard-core gamers, and with good reason. Products such as the F-16 FLCs are realistic, reliable, feature-laden, and—as you might expect—expensive. Thrustmaster's latest joystick, however, isn't another gee-whiz dividend from the military-industrial complex. It's the XL Action Controller, a

low-end stick designed to compete with products like the Logitech Wingman and other, more affordable sticks. Its low price and strong lineage make the XL Action Controller an excellent choice for new gamers or for those who don't need all the features of an F-16 FLCS.

The XL Action Controller has a four-way hat switch (which allows you to change your point of view in a game) and four buttons: two near the hat switch, a trigger, and a "pinkie" button near the base of the handle. The hat switch



XL ACTION CONTROLLER

and buttons are not quite as nicely modeled as those on more expensive sticks, and the XL has no throttle control or trim adjustment. But at such a low price, the XL is a bargain.

The stick is quite compact and light, and it offered smooth movement in both the x and y axes, despite feeling somewhat less solid than other sticks. The big test for this joystick may be its ability to withstand the wear and tear associated with long hours of gameplay. If it proves to be durable, the XL should be an attractive option to a great many gamers.

We tested the XL Action Controller with a number of popular games. It worked well with Wing Commander III, although the game couldn't utilize the stick's hat switch, despite the latest Thrustmaster joystick patch for Wing Commander III. The XL also worked nicely with Descent, providing excellent responsiveness. The stick's lack of buttons makes it more suited to action and arcade games—which is exactly the target market.

—Bernard H. Yee

F-16 Combatstick

CH Products; 619-598-2518.

Circle 442 on reader service card

★★★★ \$99.95

Like Thrustmaster, CH Products is a familiar name to most gamers. The venerable CH Flightstick PRO is a favorite among those users not willing to fork over the big bucks for a high-end Thrustmaster stick. While Thrustmaster introduced a low-end stick, however, CH rolled out a line of higher-end sticks. The new three-product F-16 series, modeled after the control sticks in real F-16 fighters, is impressive from top to bottom.

The series includes the high-end Fighterstick (\$139.95), the Combatstick (\$99.95), and the Flightstick (\$69.95). We looked at the midrange Combatstick,



F-16 COMBATSTICK

which features two four-way hat switches, five buttons, and a trigger. The Combatstick also sports a rotary throttle control on the stick's base. This stick is not programmable when used by itself, but will be when used in conjunction with the CH PRO Throttle, an advanced

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throttle control system.

We tested the F-16 Combatstick—which feels like it provides more accurate control than the CH Flightstick Pro—with MechWarrior 2. The stick functioned well, even though MechWarrior 2 is tough to control with most joysticks. Also, the F-16 Combatstick felt right at home when we tested it with U.S. Navy Fighters. Neither of these games has built-in support for the Combatstick, which means that you lose some of the stick's functionality through CH Flightstick PRO emulation mode. As new games come out, however, you should see more support for the Combatstick and its siblings.

All in all, the Combatstick is a solid, excellent joystick with great feel.

—Bernard H. Yee

configuration software utilizes a Windows-like interface to make programming the buttons an easy task. You can even program such things as two separate key functions so that a button will execute one



FIREBIRD

as a key press and another as a key release. Finally, you can generate a PCX-format button diagram to help you remember what settings you assigned to each button.

The Firebird's stick is fairly comfortable and has two trigger buttons on the handle. The top of the handle is crawling with buttons, all small but within easy reach of the thumb. By the time you read this, Advanced Gravis hopes to have released a new handle for the Firebird, one more curved and ergonomic. An upgrade will be available to current owners.

The Firebird worked well with MechWarrior 2, Wing Commander III, and U.S. Navy Fighters. In fact, we relied heavily on the programmability of the stick for all of these games.

—Bernard H. Yee

Firebird

Advanced Gravis; 604-431-5020.

Circle 443 on reader service card

★★★ ~~\$99.95~~

Advanced Gravis's first joystick, the Phoenix, was quite impressive visually, with a mouse-like throttle and rudder control and a large base with over 20 buttons. One of the gripes with the Phoenix was the fact it took up quite a bit of real estate on the desktop. So the Phoenix got a little brother: the Firebird. This stick is very similar to the Phoenix but is smaller and has fewer buttons (a mere 17). The Firebird also has a throttle and trim control built into the base.

Unlike any of the other sticks in this roundup, the Firebird is completely programmable. It plugs into the joystick and keyboard ports and allows you to assign keystrokes to each of the stick's buttons. The DOS

Microsoft SideWinder 3D Pro

Microsoft Corp.; 800-426-9400.

Circle 444 on reader service card

★★★ ~~\$59.95~~

Continuing its multipronged assault on the gaming market, Microsoft recently introduced the Microsoft SideWinder 3D Pro (\$59.95).

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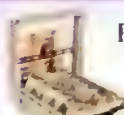
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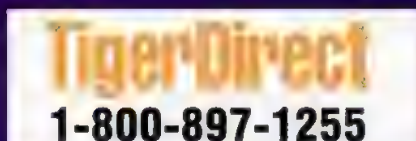


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★★★ \$59.97

The other joysticks reviewed here are all analog in design, meaning that they use devices called potentiometers to sense the stick's location and report it to the game. But the SideWinder 3D Pro uses digital technology to sense stick movements through a series of LEDs.

This is supposed to result in better performance and more precise control, but we were unable to detect any significant difference between the performance of the SideWinder 3D Pro and any other quality joystick we've used. Also, although the joystick is designed to be used with Windows 95 (it works fine under DOS, too), we had trouble calibrating it using the Windows 95 joystick applet.

Other than MechWarrior 2 and Microsoft Fury³, no games currently take advantage of the SideWinder 3D Pro's digital capabilities. Both of these games responded well to the stick's input, however. With

luck, we'll see more Windows 95 games in the near future that include native support for the SideWinder 3D Pro.

In the meantime, the SideWinder 3D Pro is a fine joystick for DOS games. It is solid, well designed, and fits comfortably into the hand. The handle twists to provide a rudder control, and a throttle control is located on the heavy base. The stick can also emulate CH and Thrustmaster joysticks. It's great for both high-end flight sims and down-and-dirty action games.

—*Michael E. Ryan*



MICROSOFT SIDEWINDER 3D PRO

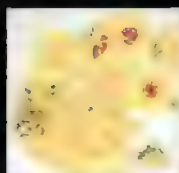


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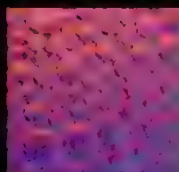
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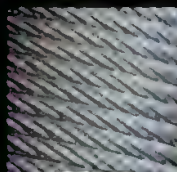
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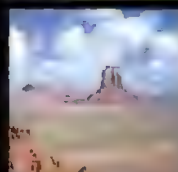
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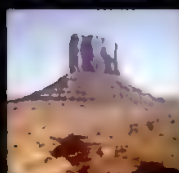
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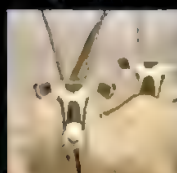
Textures II



Landscape Backgrounds



Monument Valley



African Wildlife



Agates, Crystals & Jaspers



Exotic Tropical Flowers



Australia's East Coast



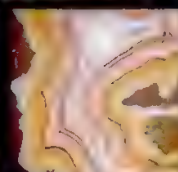
Bobbleheading



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Army



Patterns in Stone



Alligators, Crocodiles & Reptiles



Classic Aviation II



St. Moritz



Classic Aircraft Illustrations



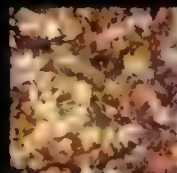
Women by Jack Cutler



Textures by Frank Scott



Contemporary Fabric



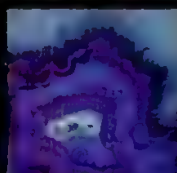
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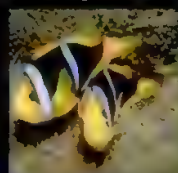
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Agates



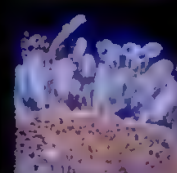
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Strategy

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Caesar II

Sierra On-Line; 800-757-7707,
206-649-9800; Web,
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★★★★   \$59.95

You may have successfully managed your own simulated city or created a globe-conquering civilization, but do you think you have what it takes to build Rome? That's exactly the challenge that awaits you in Caesar II, one of the best strategy games of the year.

You're the governor of a Roman province that starts out devoid of

just about everything. It's up to you to create a thriving capital using the Roman amenities of the day. You have to figure out where to build houses, how to map out streets, and where to set up the other things Romans crave, such as temples, forums, and public baths. You must carefully manage your taxes, make sure



QUICK CLIPS

Recommended
in Your Club
Not Recommended

Music: The Screen Raver

This incredibly trippy product plays hypnotic animations to the beat of your favorite audio CDs. A bit much for use as just a screen saver, but very cool nonetheless. Could this be the lava lamp of the nineties? \$20; Millenium Media Group; 800-892-6848.

Grammar Rock

How could we not like a CD-ROM that includes some of those great "Schoolhouse Rock" video clips? In addition to several basic grammar lessons, this title is highlighted by "Conjunction Junction" and other old favorites. Oh, and the kids will like it, too. \$39.95; Creative Wonders; 800-543-9778.

Sail 95

Without a doubt, the definitive simulation of sailing, replete with 1,024-by-768 SVGA graphics and beautifully rendered yachts. The wonder of this sim may be lost on those not into sailing, though. \$59.99; Vivid Simulations Inc.; 203-349-2011.

Dagger's Rage

This Windows 95 title is sort of like Origin's Privateer from an arcade perspective. Neat idea, mediocre execution. \$49.95; Microforum; 800-465-2323.

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BYTE
BEST OVERALL
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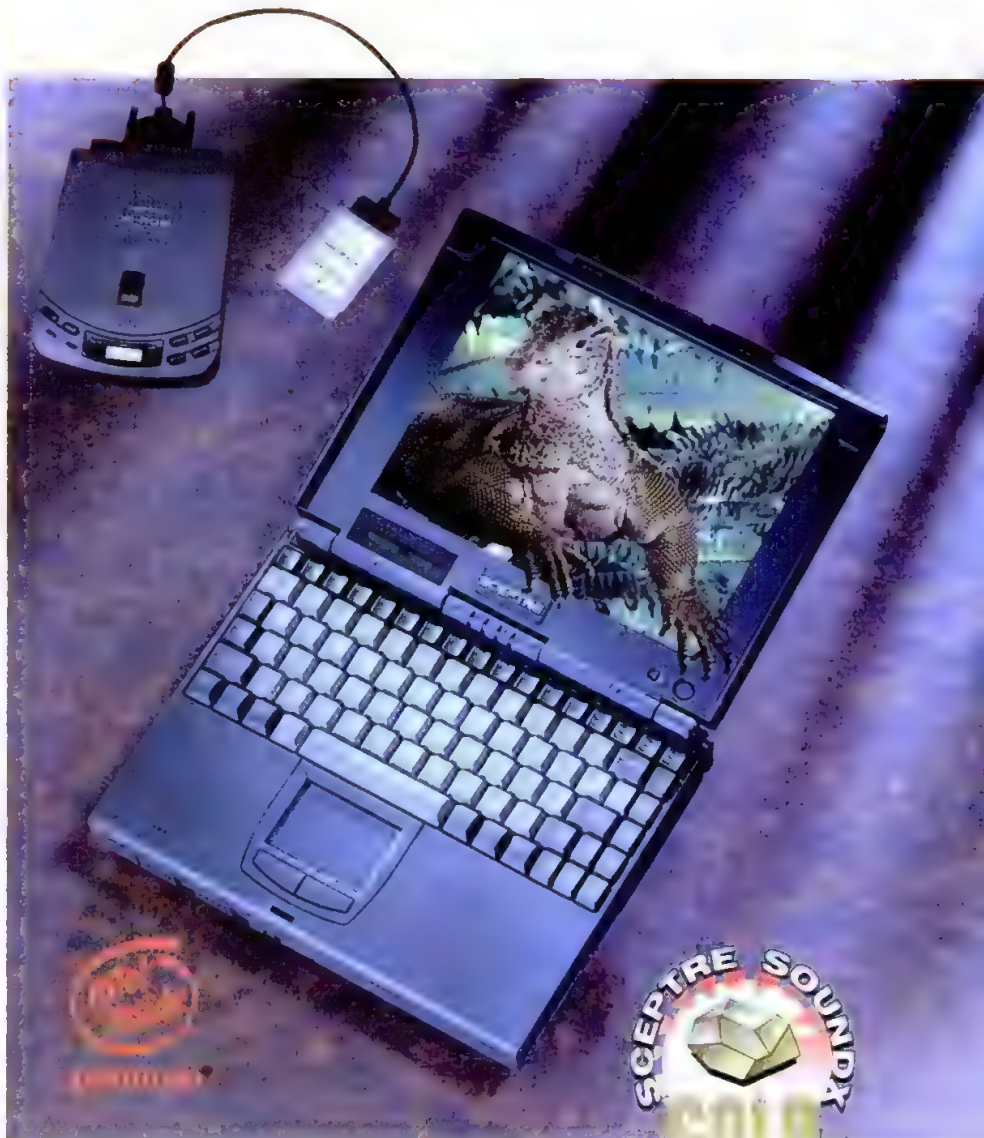
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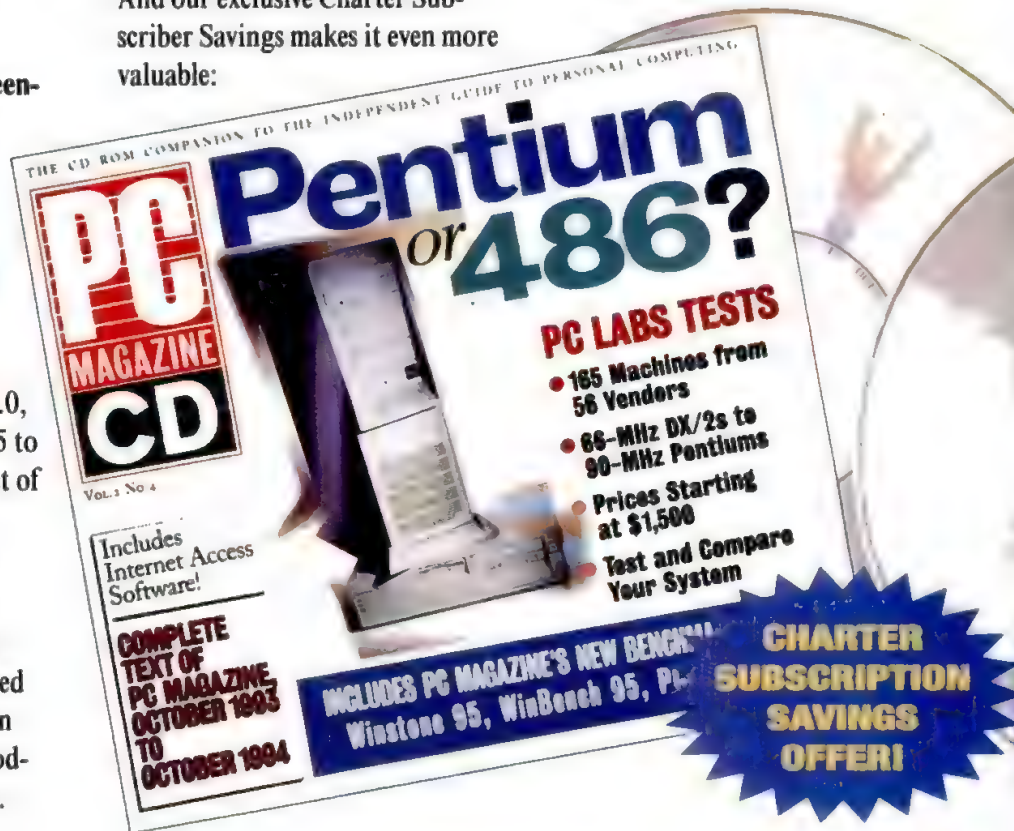
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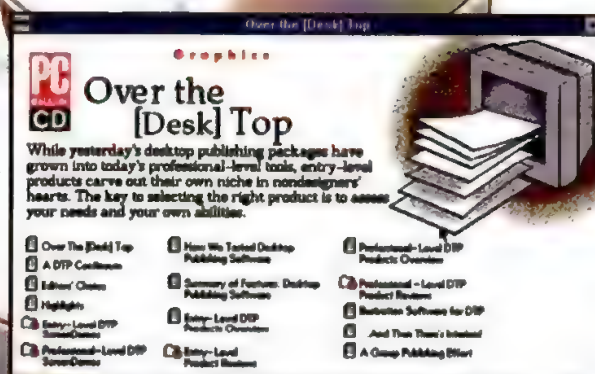
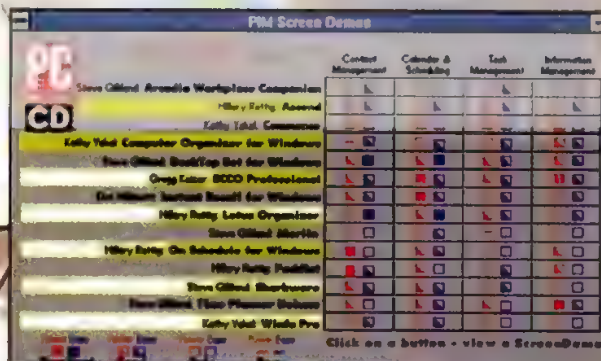
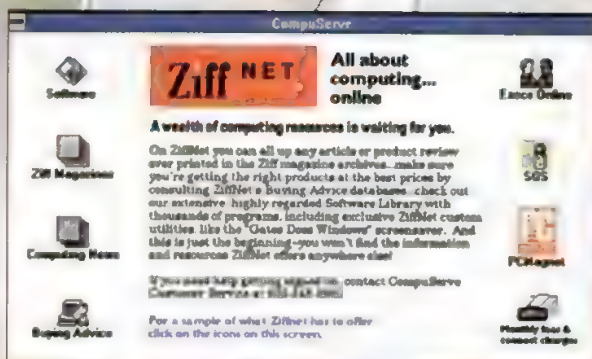
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After Hours

you have enough plebeians to do all this work, and keep your property values high to prevent riots or—even worse—incur the emperor's disfavor.

But this isn't "*Et tu, SimCity?*" You have to pay attention to lots of details, such as developing your properties through several additional stages, setting up trade routes, staking out mines, and of course, engaging in the occasional battle for other developing townships. Caesar II is something like Civilization with a SimCity-style interface.

The one thing that might turn some gamers off is the real-time combat sequences. In this type of strategy game, the real-time combat seemed a bit out of place. Although it was fun to watch miniature animated battles, it puts a lot of pressure on you to think fast in battle. But this is a minor grievance and is a question of personal taste. Some strategy fans may even prefer the real-time combat.

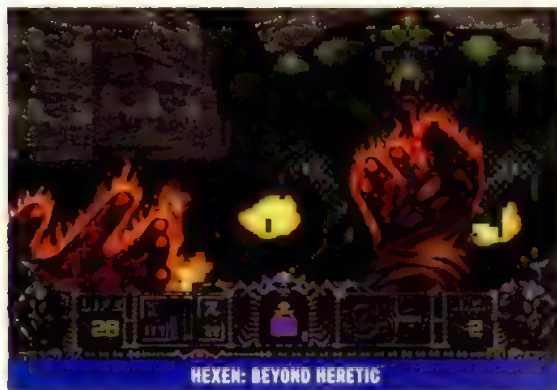
If you're a strategy fan who lost sleep over SimCity, you might as well forget about sleep with Caesar II. Just beware the Ides of March.

—Shane Mooney

SPOTLIGHT ON ACTION

Hexen: Beyond Heretic

The deathly quiet chills you as you stand in the courtyard. Suddenly, the silence is shattered by a clap of thunder and the air is filled with distant shrieks and groans. You realize that your world has become a living nightmare as an army of two-headed crea-



tures advances. One look at the clubs they brandish leaves you with little doubt about their intentions. You have entered the world of Hexen: Beyond Heretic, where brute strength, magical spells, and sheer guts are your only allies.

Hexen is the second installment in the first-person fantasy-action trilogy from Raven Software and id Software. As in most other first-person action games, you must bludgeon your way past scores of monsters, but unlike other games, Hexen lets you choose from three character types (fighter, cleric, or mage). As you progress through the game, you will find various items and artifacts, some

of which will have different functions depending on your character type.

Travelling through caves, swamps, ice castles, and more, you search for teleporters and keys to unlock secret vaults and doorways. What makes Hexen so challenging is that you must frequently retrace your steps to use the secrets that have been found on other levels, often returning to previous battle scenes only to find new creatures awaiting your arrival.

Weapons such as the Arc of Death and the Hammer of Retribution will help to dispatch these vile beings. Also, each character can piece together a different artifact that becomes a super-weapon. Better yet, evoke the dreaded Porkelator to turn your enemies into squealing pigs.

Hexen employs the DOOM engine and is capable of network and modem play, enabling up to four players to partake in a deathmatch or cooperative-mode environment. The rules change slightly, but the action is just as intense. The intricately designed levels and supremely powerful weapons make Hexen an excellent deathmatch game.—John Delaney

GT Interactive Software; 212-726-6500; Web, <http://www.gtinteractive.com>.

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★★★★ (C) (TM) (P) (S) 90

Kids

Once upon a Time...

Hansel & Gretel and the Enchanted Castle

TerraGlyph; 708-781-4100.

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★★★★ (C) (TM) (P) (S) 90

TerraGlyph's interactive storybook, Hansel & Gretel and the Enchanted Castle, has some of the highest production values we've ever seen. Based

loosely on the classic children's tale, Hansel & Gretel incorporates a beautifully rendered and animated cartoon world with a rich score.

Each screen is liberally sprinkled with hot spots that your child can activate with a mouse click. Cupboard doors fly open, trees sway in the wind, and characters reveal clues. All the while, kids can absorb the story by paging through the various screens.

This is more than a PC picture book, though. Hansel & Gretel also has several puzzles for children to solve: Hansel

must escape from the wicked witch's dungeon and save Gretel.

Prin, an imp who has befriended the pair, plays hide-and-seek with Hansel, leading

him through the rooms using two languages: one for dialogue and one for clues. For example, if you pick English for dialogue and Spanish for clues, Prin will tell Hansel, "I'm hid-



ing behind *la puerta* (the door)." Parents select two languages—from English, French, German, Spanish, and Japanese—at the beginning of the game (both languages can be the same).

—Shane Mooney



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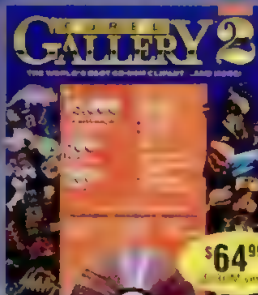
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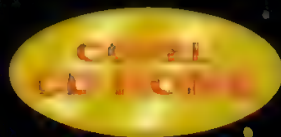
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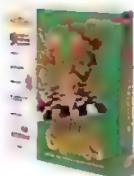
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Coming Up

Two Generations of the Pentium

Intel's newest processors have arrived on the desktop, bringing with them new levels of speed and performance not only for those in need of high-end workstation-class performance but also for those in need of that extra boost of speed for more mainstream business applications. For the former group, there's the Pentium Pro: the much-talked-about, sixth-generation processor that has been optimized for demanding, 32-bit operating environments. For the latter, there's the fifth-generation Pentium, whose speeds now reach 150- and 166-MHz. PC Labs tests 11 Pentium Pro workstations running Windows NT 3.51, and 31 Pentium machines—both 150-MHz and 166-MHz models—outfitted with Windows 95, to see which ones deserve a spot on your desktop, whether your desktop demands AutoCAD and PhotoShop, or Word and Excel.

Wireless LANs

Cut loose from your network. Wireless LAN systems give you the freedom to roam unhooked anywhere in the office or on campus. Wireless networking companies are branching beyond vertical markets that require mobility—warehouse and hospital applications, for instance—and are broadening their product lines for local-area wireless in any business setting. With throughputs averaging 1 or 2 megabits per second, they won't replace your existing cabling. But a wireless LAN can let your users work where they want to, not where they have to. *PC Magazine* tests and compares nine wireless solutions for your Ethernet network.

The Tax Man Cometh

You may as well face the facts: Tax time is here. But don't worry, our annual review of tax-preparation packages is here, too. This year we look at four Windows products as well as two products for DOS and one for OS/2. We also include some helpful hints for finding tax help on the Internet (and you might just be surprised by what we found. . .).

Windows 3.1 Resource Shootout

Windows 3.1 users who aren't upgrading to Windows 95 need to squeeze everything they can out of the memory resources they have. A number of packages are out there now that cater to this need—with widely varying degrees of success. We test five leading software memory managers for Windows 3.1 that promise to expand your system resources, speed up performance, allow more applications to load, and boost the size or efficiency of conventional memory.

Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

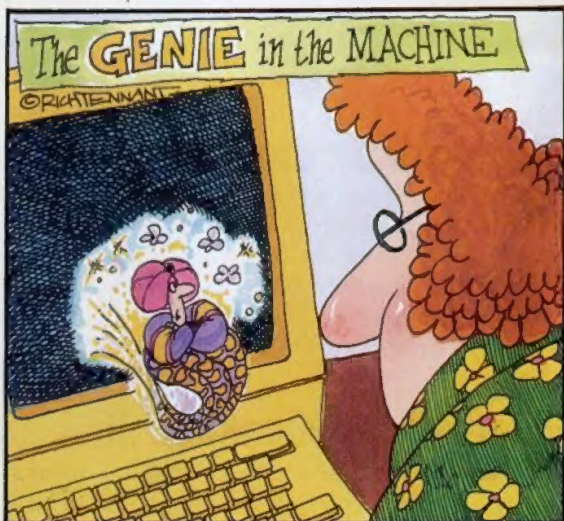
By Don Willmott

Who's Getting Insulted Here—DesignCAD or Engineers?

"You don't need a Ph.D. in engineering to make quality drawings with DesignCAD (although thousands of engineers do)."—AMERICAN SMALL BUSINESS COMPUTERS AD

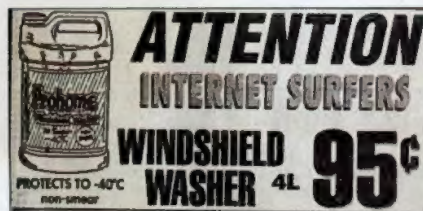


Cute baby. Not-so-cute monitor treatment. (Sears ad.)



Richard Tennant

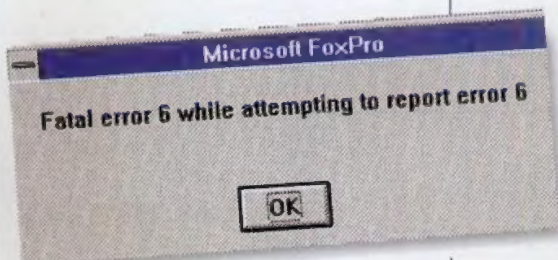
"YES, I'M NORMALLY LARGER AND MORE AWE-INSPIRING, BUT THIS IS ONLY A 4MB SYSTEM!"



Parental Guidance Suggested at This Film

"HACKERS. Computer savants, young and buff, are framed as part of a nefarious scheme to rip off a major corporation and sink its oil tankers. . . (adult language, fleeting nudity, computers)."—*NEWSDAY*

Who knows? Maybe there's some kind of connection that has to do with bugs. (*The Montreal Gazette*.)



Just try and find your way out of this FoxPro mind scrambler.



ARF on the Road: Waterloo, Ontario, Canada.

If your entry is used, we'll send you \$50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802. Winners this issue: Michael Chow, Chris Christenson, Tom Griffith, John Rolf, and Scott Shepherd.

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Pricing is not discountable. *The VeriTest Cross-Country v2.0 test simulates typical executive use of Microsoft Office® applications in Microsoft Windows® 3.11 during an airplane flight. Power management was enabled and 9MB RAM was installed. VeriTest, inc. is located in Santa Monica, CA.

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*Tests conducted by the National Software Testing Laboratories, a division of McGraw-Hill, Cos. Published in *Business Week*, November 6, 1995.